

Second Annual Report

OF THE

BOTANICAL OFFICE

Of the Province of

BRITISH COLUMBIA, 1914

By

J. Davidson, F.L.S., F.B.S.E.

Provincial Botanist

VOLUME I

PART TWO



THE GOVERNMENT OF
THE PROVINCE OF BRITISH COLUMBIA

Printed by

Authority of the Legislative Assembly

Victoria, B.C.:

Printed by William H. Cullin, Printer to the King's Most Excellent Majesty.

1915



Fig. 38. Botanical Garden, Essondale, 1914.

[Larger image: Left? — [Middle](#) — [Right](#)]

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To His Honour Frank Stillman Barnard,

Lieutenant-Governor of the Province of British Columbia.

May it please Your Honour:

The undersigned has the honour to present herewith the Second Annual Report of the Botanical Office.

H.E. YOUNG,

Provincial Secretary .

Provincial Secretary Office,

January, 1915.

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Second Annual report of the Botanical Office.

BOTANICAL OFFICE,

Vancouver, B.C., January, 1915.

To the Hon. Henry Esson Young, M.D., LL.D.

Provincial Secretary and Minister of Education, Victoria, B.C.

Sir,—I have the honour to submit herewith my Second Annual Report of the British Columbia Botanical Office for the year ended December 31st., 1914.

The past year has seen marked progress in the work of this Department. The publication of the Annual Report has been the means of drawing the attention of the principal botanical institutions in various parts of the world to the botanical research being carried on in this Province, and the numerous requests from universities and libraries to be placed on the mailing-list of this office to receive copies of future publications give some indication of the interest which has been aroused outside British Columbia.

Besides those who have applied for information on our native flora, requests have been received from some of the leading herbaria and botanical gardens in Great Britain, Australia, and the United States for herbarium specimens and live plants. In acceding to these the wealth of the flora of British Columbia becomes more widely known, and we furnish the most accurate and reliable data regarding the climatic and other conditions which favour the growth of such a varied and luxuriant vegetation.

Within the Province the interest has increased beyond our expectations. This is largely the result of an effort to interest teachers in the study of the native flora as an aid to the teaching of nature-study in schools.

It seems that many teachers had been waiting for such a stimulus and promptly took advantage of the opportunity of becoming botanical correspondents for the district around their schools. Several of those who intimated their desire to assist in this work have been enthusiastically collecting specimens and making notes on the flora, but have had to struggle along as best they could with inadequate means of verifying their determinations.

As a result of their co-operation with this office, teachers receive assistance in the identification of their specimens, so that they may act as local authorities on the plant-names in their neighbourhood.

Correspondents have also the satisfaction of knowing that the names given are in conformity with those in use in other parts of the Province and in other parts of the world whereas, at present, these vary according to the particular book at the disposal of the collector, and, as most of our Western floras are compiled by American authors, there is no uniformity in plant-names; their nomenclature does not conform to the rules drawn up at Vienna by the International Congress of Botanists.

(1.) The Herbarium.

The growth of the Herbarium has been so rapid that our accommodation was taxed to its utmost capacity. It was necessary to get six more herbarium cases, providing seventy-two additional compartments; this enabled us to thin out certain sections which were overcrowded.

The continued influx of specimens made it necessary to move to more commodious quarters, and, as the Herbarium, records, library, etc., were increasing in value, it was considered advisable that these should be protected in fire-proof rooms.

On October 1st the Botanical Office was transferred to the London Building, where it is believed sufficient accommodation has been secured to meet the needs of this Department until permanent quarters are provided.

During the summer over 120 collections of specimens came into the office for identification from different parts of the Province; some of these contained close on 300 specimens. Several correspondents sent in collections at different seasons as the plants came into flower or fruit. In practically every instance the specimens were sent to be retained in the Herbarium according to the arrangement set forth on pages 8-10 in the Report for 1913. In this way specimens were received from the following localities:—

Armstrong.—Charles Webster, Esq.; Eli Wilson, Esq., B.A. (six collections).

Atlin.—W. G. Paxton, Esq. (four collections) ; R. Pelton, Esq. (two collections).

Blue River (North Thompson).—David McLaren, Esq.

Boswell.—Mrs. E.L. Wallace.

Crawford Bay.—H. Murray, Esq.

Chilkat.—E. S. Wilkinson, Esq., B.C.L.S.

Chu Chua (North Thompson).—Miss D.M. Jones.

Finlay, Parsnip, and Ingenika Rivers (Headwaters of Peace River).—G. V. Copley, Esq. (288 specimens).

Golden.—R. Landells, Esq., B. A.

Graham Island (Masset).—C. de B. Green, Esq., B.C.L.S. (four collections).

Groundhog Country.—T. H. Taylor, Esq., B.C.L.S. (a few specimens).

Hedley.—Mrs. H. C. A. Cornish, Rossland.

Kamloops.—Miss Muriel Costley; James A. Wattie, Esq., M. A.

Liard River.—E. B. Hart, Esq.

Malcolm Island.—John Stephen, Esq., M. A., Sointula.

McBride.—J. A. Walker, Esq., B.C.L.S.

Mission City.—Miss A. S. Mackenzie (seven collections).

Nelson.—M. S. Middleton, Esq.

New Westminster.—Mrs. A. Lyall.

Point Grey.—J. Bain, Esq.

Prince Rupert.—M. L. Bird, Esq. (ten collections); M. S. Howitt, Esq.; H. S. Irwin, Esq.

Rossland.—H. C. A. Cornish, Esq., B.C.L.S. (two collections).

Spences Bridge.—J. A. Teit, Esq. (four collections). (Fig. 39.)

Vancouver and District.—Miss MacNaughton; Mrs. Morris (four collections); A. E. Baggs, Esq.; F. Perry, Esq.; H.

Sampson, Esq.; W. Taylor, Esq.; R. Thorburn, Esq.

Vancouver Island.

Victoria.—Mrs. J. T. Higgins (three collections); C. C. Pemberton, Esq. (two collections); W. H. Robertson, Esq.; F. M.

Philips, Esq.; E.S. Wilkinson, Esq., B.C.L.S.

Cowichan Lake.—G. B. Simpson, Esq.

Duncan.—Mrs. Stoker.

Saanich Inlet.—Gerald O. Case, Esq., M.S.E. (Victoria).

Nanaimo.—Professor A. B. Klugh, Queen's University, Kingston

Holberg.—H. H. Browne, Esq., B.C.L.S.

Port Alberni.—Dr. C.T. Hilton (six collections).
Ucluelet.—J. G. Darling, Esq., B.Sc. (five collections).
Vavenby (North Thompson) —E. P. Heywood, Esq., B.C.L.S., Kamloops.
Windermere.—Miss A. B. MacKenzie.

In addition to these, large collections of specimens were secured during botanical exploration expeditions to the Garibaldi Mountain region and to the mountainous region between the Lower Thompson and Fraser Rivers. Full details of the former are given later on in this report.

In the short time that has elapsed since the establishment of this office almost 8,000 sheets of herbarium specimens have been prepared as the nucleus of the Provincial Herbarium. These represent over 540 genera, and all are native plants of British Columbia; it being practically impossible to undertake the formation of a general Herbarium without much further addition to our staff and accommodation.

In the early part of the year the “Eli Wilson collection” of over 1,000 specimens, donated towards the end of December, 1913, was gone through and all the specimens poisoned and remounted on standard-size herbarium sheets, with the exception of some two or three hundred duplicates.

Over 1,160 sheets have been remounted and incorporated in the Herbarium, each sheet being stamped with the donor's name. The collection contained many rare and interesting species, and is a valuable contribution to our collection of the flora of the interior.

(2.) Volunteer Correspondents.

We have to acknowledge our indebtedness to the whole-hearted co-operation of those who have undertaken to act as botanical correspondents for their district. Much interesting and valuable information regarding the flora and the conditions existing in some of the little known districts in the Province has been obtained from the collections received.

Of the forty-nine names mentioned in the foregoing list, twenty-four appeared in the last Annual Report; this indicates that their interest has not flagged. Twenty-five new correspondents have taken part with the above in sending in 124 collections, compared with sixty-four sent in last year.

Every week sees the addition of new correspondents ; many of these are teachers and this suggests the beginning of a new era in the teaching of nature study in the Province, if the children are encouraged to bring specimens to school so that the teacher may name them, the information is carried by the child to its home ; in this way parents have an opportunity of becoming acquainted with the names of the common plants around them, and are enabled to distinguish between native plants and introduced weeds.

The following have intimated their desire to co-operate by supplying specimens of the flora of their district during 1915, being too late to make a commencement in 1914

Matthew Beatty, Esq., Anaconda.
George Bowyer, Esq., Cowichan Station.
J.B. Brown, Esq., Fairview, Okanagan.
Miss A.L. Burpee, Princeton.
Edgar Clark, Esq., Brisco.
Laurencee M. Colpitts, Esq., Clinton.
W. Croft, Esq., B.A., Kaslo.
Miss G. Davies, Field.

Claude Emry, Esq., Hosmer.
Miss A. M. Easton, Keremeos.
Andrew Flett, Esq., Corbin.
Miss A. Holman, Riondel, via Nelson.
W. Kidman, Esq., Crawford Bay.
Miss F. K. Lawrence, Larkin.
Sherley MacDonald, Esq., Creston.
Miss Blanche MacDonald, Nanaimo.
Miss Edna Macpherson, Cascade.
Miss E.A. Murray, Nicola.
Miss E.F. Murray, Wardner.
Miss L. Nilsson, McMurdo.
H. Paterson, Esq., Wilmer.
Mrs. E.P. Simmons, Big Bar.
Miss M.E. Slack, Albert Canyon.
T.L. Thacker, Esq., Hope.
J.F. Tupper, Esq., Kaleden.
Miss K.E. Walker, Heriot Bay.
Percy E. Warner, Esq., Fort George.
R.F. Worthington, Esq., Porcher Island.
G.H. Wailes, Esq., F.L.S., Cortes Island.

Altogether fifty-four new correspondents have been added to our list during the year, and, as will be seen by observing the localities, this justifies the anticipation that many valuable collections will begin to come in with the return of spring.

(3.) Co-operation of British Columbia Land Surveyors.

One cannot overestimate the value of the assistance of surveyors in the field, especially those engaged in the exploration of new regions of the Province. Survey parties in the past have gone into districts where the flora was absolutely unknown, and have returned with practically no information concerning the vegetation of the country, further than a few observations regarding the timber.

Through the courtesy of the Surveyor-General, G. H. Dawson, Esq., surveyors in the field are allowed to render such help as they can to the Botanical Office, provided it does not interfere with the particular work they have to accomplish.

If a surveying party is out from three to six months, and if one member of the party devotes but half an hour each week to collecting Specimens in his immediate vicinity, he has no difficulty in finding in that time from twenty to forty different including grasses and sedges, as well as the ordinary flowering plants which appeal most to him. Taking an average of thirty per week, he is able to bring or send back from 300 to 700 specimens to illustrate the flora of the region traversed. Three hundred specimens, including wrapping-paper, etc., weigh less than 4 lb.; this does not seriously impede the progress of regular survey work.

Definite information on the vegetation of any region incorporated in a surveyor's report adds much to its interest and value, especially if available for future reference by scientific men in solving some of the problems of an economic nature in the Province.

A few surveyors who appreciate the utility of such cooperation have been supplied from time to time with lists of the specimens sent in by them, so that the information can be recorded in their reports.

Apart from its scientific value, it is of economic importance to know the flora of every region. Certain associations of plants indicate whether the soil and climate is suitable or unfit for agricultural purposes. Some species are characteristic of muskeg land, others of rocky ground, others of cold regions and high altitudes, and so on. The flora tells accurately the conditions existing in each area.

Collections received from surveyors have resulted in the supply of valuable data regarding the distribution of certain species in the Province. Plants which were formerly believed to be rare have turned out to be widely distributed in British Columbia. Other specimens are valuable in showing intermediate stages of variation, giving us a fuller knowledge of some closely allied species in critical genera.

The following surveyors have helped in this work during 1914:—

H.H. Browne, Esq., B.C.L.S.
G.V. Copley, Esq. (assistant to F.C. Swannell, Esq., B.C.L.S.).
H.C.A. Cornish, Esq., B.C.L.S.
E.B. Hart, Esq.
E. P. Heywood, Esq., B.C.L.S.
T.H. Taylor, Esq., B.C.L.S.
J.A. Walker, Esq., B.C.L.S.
E.S. Wilkinson, Esq., B.C.L.S.

Most of the above have called at the Botanical Office from time to time, and have been shown how much assistance they can give without interfering with their other duties.

(4.) Botanical Garden. (Frontispiece, [Fig. 38.](#))

It is believed that one of the best ways of “boosting” (if I may be permitted to use a Western word) the climate of British Columbia would be by the establishment of a large public Botanical Garden devoted chiefly to the display of native herbs, shrubs, and trees.

This in conjunction with a well-equipped Botanical Museum and Herbarium would give visitors from all parts of the world an opportunity of seeing at a glance the enormous variety of beautiful, curious, and useful plants indigenous to British Columbia. Probably no one would be more surprised than those who have made British Columbia the land of their adoption. There are so many different environments between the Coast and the Rocky Mountains, and between the southern and northern boundaries — each particular environment supporting a vegetation peculiar to itself — that the majority of British Columbians are only familiar with the flora of their own immediate vicinity ; many have not even reached that stage.

If supplies of characteristic plants from the regions in Kootenay, Columbia. Fraser, and Peace River Valleys, from the northern region east and west of Atlin, and from the Coast and islands were brought together, it would constitute One of the most unique and interesting collections to be found on this continent.

Yet this is what may be seen on a small scale in the Botanical Nursery at Essondale. Hundreds of specimens have been transplanted from most of the above regions, and are now thriving vigorously within twenty miles of Vancouver. The cactus, sage-bush, and milkweed of the hot, arid Dry Belt may be seen growing side by side with the Rocky Mountain anemone, yellow erythronium, and other plants from the regions of perpetual snow, or with the beautiful iris from the more northerly regions.

Notwithstanding the distance, many visitors have gone to see the collection at Essondale, and practically all have expressed the wish that the gardens were nearer Vancouver and more accessible, so that more frequent visits could be made at different seasons in order to see the various plants in flower.

Considerable progress has been made towards the formation of an arboretum of the native trees and shrubs. This, it is hoped, will form an attractive feature when transplanted to the grounds of the Provincial University. Some of the more showy specimens are being propagated, so that they may be available for use in landscape-work.

In addition to this, new species are being added to the collection of native herbs, comprising many plants of great beauty, as well as some of economic importance, including grasses from various parts of the Province. Then there are sets of species belonging to particular genera which are being cultivated for research-work on variation, etc., and rare species are reared for exchange with other botanical institutions.

Dr. C.E. Doherty, the Medical Superintendent at Essondale, has given the use of a small ravine in which runs a small creek, so that it may be planted with various native plants. This will enable us to grow several aquatic species, which, through the lack of a suitable environment, we formerly had no proper facilities for. Two small lakes are being made, and it is proposed to use these as well as the banks of the creek for the establishment of such plants as require an aquatic environment.

During the year, seeds or specimens for the nursery have been received from the following:—

G.V. Copley, Esq., Victoria (seeds from headwaters of Peace River).

H.C.A. Cornish, Esq., B.C.L.S., Rossland (seeds).

David Gellatly, Esq., Gellatly, B.C. (plants).

C.F. Newcombe, Esq., M.D., Victoria (seeds).

W.G. Paxton, Esq., Atlin (plants).

R.L. Pelton, Esq., Atlin (plants).

F.M. Philips, Esq., Victoria (bulbs).

C.C. Pemberton, Esq., Victoria (plants).

H. Sampson, Esq., Vancouver (bulbs).

William Sinclair, Esq., Port Moody (seeds).

Mrs. Stoker, Duncan (seeds and plants).

J.A. Teit, Esq., Spences Bridge (seeds and plants).

T.L. Thacker, Esq., Hope (plants).

Mrs. L.E. Wallace, Boswell (plants).

J.A. Wattie, Esq., Kamloops (plants).

Charles Webster, Esq., Armstrong (plants).

E.S. Wilkinson, Esq., B.C.L.S., Victoria (roots). ([Fig. 40.](#))

Eli Wilson, Esq., Armstrong (seeds and plants).

Tom Wilson, Esq., Vancouver (plants from Bulkley Valley).

In connection with our study of variation in *Amelanchier*, specimens and fruits were received from:—

W.W. Price, Esq., Lake Tahoe, California.

L.S. Smith, Esq., Cisco, Placer County, California.

These included interesting variations leading up to an extreme form which had been raised to specific rank under the name *Amelanchier glabra*(Greene). Seeds of the latter were obtained and have been sown, so that the variation may be noted and compared with that shown by our native species.

A number of packages of seeds were received from the Royal Botanic Gardens, Kew, Eng. These have been sown and kept separate from our native plants. They include particular species of grasses to be used in future research on the members of this family.

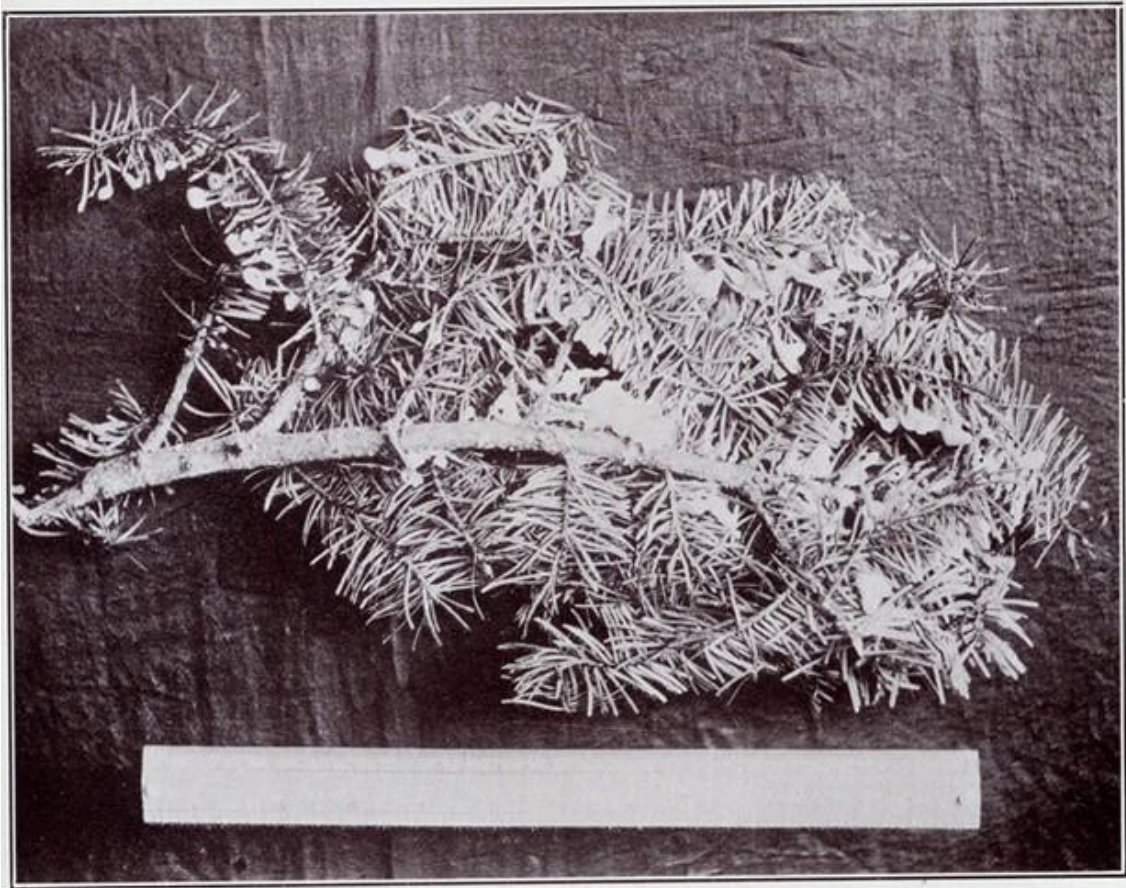


Fig. 39. Fir-sugar. Specimen of *Pseudotsuga Douglasii*, with exudation of sugar from water-pores at tips of leaves. Found frequently in Dry Belt. [[Larger Image](#)]

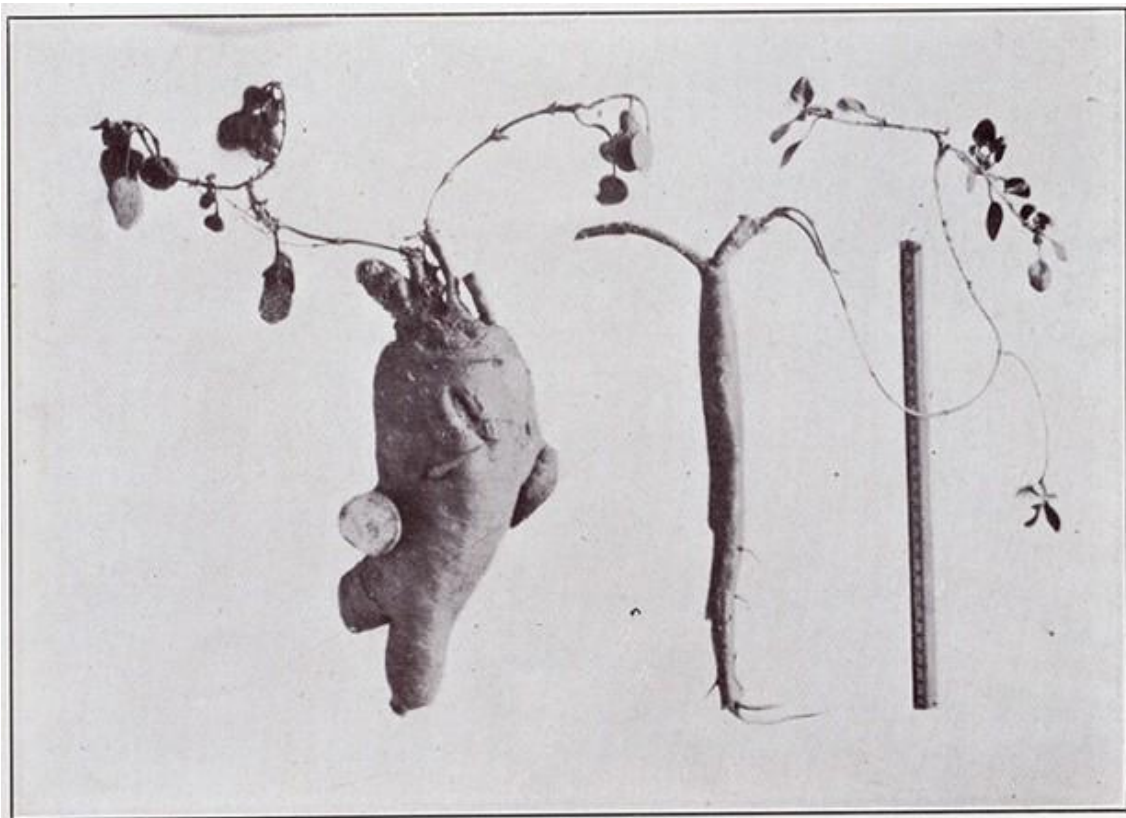


Fig. 40. Roots of *Abronia latifolia*. From sandy beach near Victoria, showing great size of root (compared with one-foot rule in photo). Plant is low and fleshy.

As director of the botanical work at Essondale, it is necessary to make frequent visits to the nursery during the summer, particular attention having to be paid to those species which are being grown for research-work.

With the garden in proximity to the Botanical Office, this work could be under closer supervision and daily observations made, but being approximately twenty miles apart the time occupied in travelling has to be taken into account, and the number of visits limited accordingly. During the season from March to November seventeen visits were made, on several occasions accompanied by botanical correspondents, who in every instance returned with greater enthusiasm towards assisting in this work.

The Botanical Gardener, in his report for this year, supplies the following data:—

3,500 cuttings have been prepared of showy or rare species.

216 packets of seeds were sown in seed-boxes, in addition to those sown directly in the beds.

10,000 young plants are being protected in frames during the winter.

7,650 plants are in the garden (including duplicates), numbering over 600 species.

350 specimens in the collection of native trees (approximately thirty different species).

780 specimens were received from different parts of the Province; about twenty- five or thirty of these died.

425 permanent lead labels have replaced the former wooden ones.

53 habitats have been prepared for bog—plants, and 47 habitats for Dry Belt specimens.

It may be of interest to explain how the ground is prepared for time reception of plants requiring special habitats.

For bog-plants a hole is dug approximately 3 feet in diameter and 2 or .3 feet deep. The sides and bottom of this are plastered with 3 or 4 inches of soft clay, and then filled up with a compost prepared with peat and loam, according to the species to be planted. The clay helps to retain the moisture for the particular species planted there, and prevents the adjoining habitat from receiving more moisture than is necessary.

For Dry Belt plants a similar hole is dug and only the walls lined with clay; the bottom is filled with rocks and gravel to provide free drainage, and a compost is prepared from sand and loam, according to the species to be planted. In either case the casual observer sees no trace of this special preparation, as the top of each habitat is usually covered by an inch or more of ordinary garden soil.

In many cases the plants would grow without such precautions being taken, but some would be abnormally developed, while others would be stunted, resulting in the plants presenting an unnatural appearance.

This year one corner of the garden was too wet for Dry Belt species and had to be drained. This necessitated the digging of a ditch 372 feet long, in the bottom of which was laid a 1-foot box drain of cedar.

Several loads of clay, loam, sand, and gravel have been dug and brought to the garden in preparation for next season.

(5.) The Staff. ([Fig. 41.](#))

Assistant Botanist.—Last year the appointment of an Assistant Botanist helped greatly to prevent the congestion which must inevitably have resulted from the increased number of collections received.

J.A. Wattie, M. A., late Instructor in Botany at Kamloops High School, was appointed to this post and commenced duty on June 1st. He has been engaged in attending to collections as they are received, assisting in their classification, and recording them for the various districts from which they are sent. He has also taken part in carrying on research-work in particular groups of plants where sufficient material has accumulated, besides assisting in general herbarium and field work.

Herbarium Assistant and Stenographer.—The duties of this dual post have now become so heavy as to make it desirable to separate them. Miss M. Gruchy, who was appointed on June 1st, 1912, as stenographer, has gone through a course of training in the various departments of herbarium work, and in her own time has attended classes in botany in order that she might more efficiently perform these duties.

During the past year the work of the herbarium Assistant has been greatly increased by the numerous collections received from correspondents; so much so that at times it has been necessary to utilize the services of the Assistant Botanist in order to cope with the pressure, which is usually greatest at a season when his services are required for more technical work. It is therefore desirable that the herbarium Assistant should be free to devote her whole time to the preparation of the specimens for the Herbarium; this includes the pressing, drying, poisoning, and mounting, and also the preparation of fluid specimens for future laboratory or museum work. The Herbarium Assistant has also to account for the various collections until they have been worked out and recorded and finally incorporated in the Herbarium.

The stenographic work of the office has also increased in volume, especially since the publication of the report. In this department over 800 letters have been dictated during the year, and this number would have been greatly augmented had the conditions in Europe been normal. The bulk of this correspondence, however, has been Provincial, and there seems no likelihood of it diminishing; on the contrary, from the number of teachers throughout the Province who have recently intimated their desire to act as botanical correspondents, there is every indication of an increase during 1915.

Botanical Gardener.—In connection with the Botanical Nursery at Essondale, it is essential to have a responsible man to take charge of the specimens received from this office or sent direct from our correspondents. Mr. I. van der Bom, who for several years had a large nursery business in this Province, was appointed to this post at the inauguration of the Botanical Nursery two years ago, and his horticultural training and experience has been invaluable in saving many specimens which would have been lost in the hands of a less capable man.

Many of the specimens have to be collected at the wrong season of the year for transplanting, and often suffer a good deal during transportation. Sometimes, on account of having to send specimens by several days journey on pack-horses, and further delays at railway-stations or shipping depots, the specimens arrive in what appears to be a hopeless condition; but through careful nursing in the frames the vast majority have been successfully reared and transplanted to the beds in the nursery.

In other cases, when it is impossible to secure specimens for transplantation, efforts are made to obtain seeds, and these are sown either in the beds, or in frames and afterwards planted out. In every case the gardener has to keep record of the locality from which specimens have been received, and treat each species as nearly as possible according to its natural environment. So far this has been done successfully, and one can see plants from the hot, arid regions of the Dry Belt growing practically side by side with specimens from the perpetual-snow regions of our high mountains, or with specimens from a more humid environment near the sea.



Fig. 41. Botanical Office staff at Botanical Gardens, Essondale.
From left to right----I. Van der Bom (Gardener), J.A. Wattie (Assistant Botanist), Miss M. Gruchy, (Herbarium Assistant), J. Davidson (Botanist). [[Larger Image](#)]

(6.) Proposed Experimental Work. Introduction of New Species of Economic Value.

Various botanical and horticultural institutions throughout the world are engaged in carrying on experiments on the introduction of new species of more or less economic importance. Up to the present time we have been devoting practically our whole attention towards acquiring native species. One feels, however, that a suitable tract of land might be secured in the Dry Belt in order to experiment on the introduction of species adapted for these hot and arid regions.

The vast areas which are at present unproductive may yet be turned to good account if suitable herbage could be grown. It may be necessary to first introduce from other countries trees adapted to such an environment, so that the resulting shade might permit the growth of grasses or other plants of economic importance.

The mildness of our winters and the long growing season, accompanied by a sufficient rainfall, is a great asset to the south-west part of British Columbia in experimental work on the introduction of new species. Other gardens on this continent have received supplies of seeds of many choice herbs, shrubs, and trees from Europe, China, Australia, etc ; many of these have been lost on account of the severity of their winters or the long drought during summer.

It would be interesting to see what can be done in British Columbia in plant-industry work. We have been offered the assistance and co-operation of botanical institutions on this continent as well as in Australia, Europe, and the Far East. In the meantime, however, we have no provision made to undertake this on a proper scale, and must be content to introduce only those of special botanical value.

(7.) Lectures on Botany.

Long before the date of the opening of the School Board evening classes, inquiries were being received from suburban districts as to whether or not these lectures were to be repeated. This was followed later by a request from the Secretary of the Botanical Section of the British Columbia Mountaineering Club to deliver another course.

Through the courtesy of the Board of School Trustees a class-room in the old High School on Dunsmuir and Cambie was placed at our disposal and the classes resumed on October 27th. As in previous years, two lectures given each Tuesday—the elementary from 7.30 to 8.30, and the advanced from 8.30 to 9.30. These are illustrated by diagrams, specimens, and microscope preparations.

Of the forty-seven students attending the class, several are school principals and teachers the others represent many trades and professions, and hail from all parts of Greater Vancouver one student travels twenty miles to attend the class, and of this distance four or five miles each way are done on foot. This gives some indication of the interest and enthusiasm displayed by those who wish to know more about the flora of the Province.

Following the close of each session a series of excursions is arranged in order to give the students an opportunity of studying the plants in the field. Localities illustrating different environments are selected and the relation of the flora to those habitats is pointed out. Class excursions were held to the following districts:—

Whiterock, returning along the Coast to Crescent. Collections of seaweeds and sea-shore plants were made. Grouse Mountain (4,000 feet), comparing the vegetation found on the wooded slopes at various altitudes with that found on the plateau and on rock-slides.

Savary Island.—During the week-end, including Victoria Day, a large number of interesting plants were found; the sand-dunes being specially instructive.

Botanical Garden, Essondale.—During this visit students had an opportunity of seeing many species found on previous excursions, and of making the acquaintance of other alpine and Dry Belt Species. Unfortunately the visit had to be cut short owing to the inconvenient train service.

In addition to the botany classes, several lectures were delivered with the object of interesting more of the general public in the native flora.

On April 21st, under the auspices of the British Columbia Mountaineering Club, a lecture was given in the large Pender Hall, Vancouver, on “The exploration of the Garibaldi Mountain Region” illustrated by slides and specimens showing the nature of the country and its flora.

On October 14th a lecture was given to the Victoria Teachers Institute in the auditorium of the new High School, Victoria, on “Some Aspects of Plant-life in the Province.” The specimens and slides illustrated the general, economic, and educational aspects.

(8.) Botanical Exploration of the Province.

Headwaters of Skoonkon, Botanie, Luluwissin, Murray and Twaal Creeks, between the South Thompson and Fraser Rivers.

Information had been received from various sources that there existed a region abounding in all kinds of beautiful and rare flowers, but considerable difficulty was experienced in obtaining details regarding the flora. The most that could be ascertained was that the upper part of Botanie Valley produced a rich supply of many of those species of plants used by Indians as food, and that in former times hundreds of Indians gathered there annually from the adjacent districts to dig roots and collect supplies for future use.

With the exception of Lower Botanie Valley, this region is seldom visited by white people. Two German botanists are believed to have collected specimens from the Lower Botanie Valley a number of years ago, and big-game hunters are known to have passed through certain parts of this area on their way north; but it is a region well known to the Indian tribes, there being at least two Indian reserves in it. At the time of our visit many Indians were met, and much interesting information was obtained regarding the uses of several of the plants which abound in the mountains and valleys.

I was fortunate in securing the services of Mr. J.A. Teit, who is well known for his ethnological work amongst the Indians. Mr. Teit acted as guide and interpreter, and the success of the trip was largely due to his intimate knowledge both of the country and of the various Indian tribes met during the journey. The information obtained from the Indians was supplemented by Mr. Teit's knowledge of the uses to which many of the plants are put by the Indians, amid visits to old camping-grounds showed to what an extent these nomadic peoples depend upon the native flora to supply their needs. The remains of root-pits, earth-ovens, sweat-houses, etc., were pointed out and their uses explained.

A large and interesting collection of specimens was made during the journey, and these have been added to the Provincial Herbarium. A series of photographs was taken to illustrate the region and its flora; a few were also obtained of Indians, and some of their implements used in collecting roots. ([Figs. 42-45.](#))

It is intended to give a detailed account of the botanical exploration of this part of the Province in the form of a bulletin to be issued later on, and, as this mountainous region is surrounded by Dry Belt country, several points of botanical importance will be dealt with which may be of future economic value to the Province.

“The Lions”

The mountains which have been so appropriately named, and which are well known to every resident in Vancouver as the highest peaks visible from the south shore of Burrard Inlet, lie about eighteen miles north by north-west from the above city. They reach an altitude of over 6,000 feet, and, from their resemblance to two prostrate lions, such as are seen at the base of Trafalgar Monument in London or so frequently displayed at the entrance to large public buildings, are easily recognized amongst the miles of peaks forming the northern horizon.

Early in the summer several mountaineers brought in from that region one or two specimens which had not been collected on the adjacent mountains, and which suggested the possibility of other rare plants being found in that vicinity.

Amongst the plants brought in was a specimen of *Geum* (*Sieversia*), closely resembling *Geum Peckii* and *Geum calthifolium*. The former has only been found on the mountains of the Eastern States and has not been recorded for Canada. The latter has been recorded for some parts of British Columbia, and it seemed more likely to belong to this species in spite of its resemblance to the description of *Geum Peckii*.

A specimen was forwarded to the Smithsonian Institution to obtain the expert opinion of Professor E.L. Greene, one of the best known botanists on the Pacific Coast.

In his reply, Professor Greene stated that it was much more closely related to *Geum peckii* than to *Geum calthifolium*, and suggested that our plant was probably a new species, being much more delicate and having “larger and handsomer” flowers than his specimens of *Geum peckii* possessed.

Unfortunately, our plants were only in flower, and the species could not be definitely settled without specimens in fruit, so it was decided to visit the region for the purpose of obtaining specimens in fruit, and also specimens for the Botanical Garden. At the same time a general survey of the flora and its environment was to be made.

I secured the services of Mr. F. Perry, an expert mountaineer who acted as guide, and who brought down the first specimens of this *Geum* to the office. Accompanied by my Assistant (Mr. J. Wattie) and Gardener (Mr. I. van der Bom), we left Vancouver at 9 a.m., on August 21st in a small launch. Soon after leaving Vancouver a dense fog was encountered which made it impossible to see when we were opposite “The Lions.” This necessitated our following the coast-line for some distance to obtain a suitable landing-place, which was found a little before noon at a point on Howe Sound a few miles north-west of our objective.

As it was estimated that the return journey over the mountains to Vancouver might occupy four or five days, we had to carry food supplies, tent, sleeping-bags, and cooking utensils, in addition to the plant-presser, botanical collecting-cases, camera, etc., sufficient for that length of time. Hence the desirability of transporting our loads by launch to the nearest point on Howe Sound.

The western slopes of the mountains—forming the foot-hills of “The Lions”—are densely timbered, and at many places drop by a series of rocky ledges to the sea. On the ledges near the sea the smooth cinnamon-brown trunks of the madrona (*Arbutus Menziesii*) stood out conspicuously amongst the more dwarf *Pinus contorta*; the underbrush was composed largely of *Vaccinium parvifolium* and *Gaultheria shallon*.

Occasionally the shore was made up of boulders and pebbles, and at such a point we landed, near the outlet of a small mountain-creek. Here, owing to time mixture of fresh and salt water, the shore was covered with a luxuriant growth of *Enteromorpha*, which from a distance stood out as a conspicuous patch of green upon the otherwise barren rocky shore.

After lunch the ascent was begun; the dense fog still continued and helped to make things unpleasant by the resulting wet vegetation, and by obscuring our view of the "lie of the country." At first the ascent was up a slope of boulders and sand of apparently sedimentary origin. This slope had a light growth of timber, and the presence of many dead trees and windfalls indicated that these alders and firs were not adapted for such an environment, except in the vicinity of creeks.

A blazed trail was struck and followed for some distance into fairly open bush composed of tall firs and hemlocks. One of the most interesting plants at this altitude (600 feet) was *Tiarella laciniata*. Throughout a comparatively large area this plant was common, associated with *Tiarella trifoliata*, which is abundant around Vancouver.

The trail was evidently an old trapper's or prospectors trail, and led upward and around the side of the mountains, becoming at times almost obliterated by fallen logs or by the dense growth of brush, and finally lost in a dense thicket of *Taxus brevifolia* (yew), *Alnus sitchensis* (mountain-alder), and *Fatsia horrida* (Devil's-club) in the vicinity of a steep mountain creek which made its way to the sea by a series of innumerable small cascades.

As the bush was so dense, in places being almost impenetrable, the bed of the creek was followed to an altitude of 3,050 feet, here about 8.30 p.m. a halt for the night was made, on a rocky slope of between 45 and 60 degrees. Time approaching darkness compelled us to spend the night on an irregular ledge of rock which scarcely provided accommodation for the party of four.

During the ascent of the creek specimens of *Geum* were found in fruit, and supplies were obtained for the herbarium as well as for the Botanical Garden. Other plants of special interest including *Romanzoffia sitchensis*, *Sanguisorba sitchensis*, *Mimulus lewisii*, and *Epilobium luteum*.

Next day at 6 a.m. the ascent was resumed, a slight breeze suggesting the possibility of the fog clearing up. After reaching an altitude of approximately 3,700 feet, we got beyond dense timber and found ourselves on the huge rock-slides surrounding the base of "The Lions" on their north side.

The lower part of these slides have a fair amount of vegetation, and one can see the gradual ascent of the flora, illustrating the transition stages between bare rock-slide and the densely wooded mountain-slopes. The vegetation higher up is limited to areas which are fed by water from the melting snow, and is composed chiefly of *Spiraea pectinata*, *Bryanthus empetriformis*, *Cassiope Mertensiana*, with a few bushes of *Cladothamnus pyrolæflorus*, and *Vaccinium ovalifolium*.

The route lay in a south-east direction across the rock-slide to a point opposite the "back" of the Western Lion. From this the ascent was steep but the slopes were well covered with *Bryanthus*, *Cassiope*, and *Vaccinium*. Round the edge of precipices occasional clumps of *Loiseleuria procumbens* and *Empetrum nigrum* were found, while on a broad ledge near the top a few more plants of *Geum* were observed.

The trees on the "back" of the Western Lion are composed chiefly of a rather scrubby growth of *Tsuga Mertensiana* (mountain-hemlock), with *Cladothamnus*, *Rhododendron albiflorum*, *Vaccinium ovalifolium*, and *Menziesia glabella* as underbrush. On the south-eastern slope of the huge amphitheatre formed by the two "Lions" and adjoining mountains, there are some small trees of *Pinus contorta*, *Pinus monticola*, and *Abies amabilis* or *grandis* amongst the more predominant *Tsuga Mertensiana*.



Fig. 42. Camp at head of Botanie Valley.
[Larger similar [Image](#) — Larger coloured [Image](#)]



Fig. 43. Lady's-slipper orchid. *Cypripedium montanum* in Upper Skoonkon Valley.
[Larger coloured detail, [Image](#)]

There were numerous large patches of snow on the top, and in the vicinity of these one could always rely on finding supplies of *Saxifraga Tolmiea*, a plant characteristic of high alpine regions. Here, too, was found *Phlox Douglasii* closely approaching the variety *diffusa* associated with *Spiraea pectinata*. Crevices and small ledges of rock bore many specimens of *Penstemon Menziesii*, *Campanula rotundifolia*, and *Saxifraga leucanthemifolia*.

On the following morning at 9 a.m. the descent was commenced via a gully leading into the amphitheatre, and an examination of the rock-slides and bluffs on the south side of "The Lions" was made, but no additions were obtained; the flowering season on these slopes, having a southern exposure, was past its best.

The descent was continued via a small creek which led us into a canyon near the headwaters of Sisters Creek; this creek was followed down through the canyon until we came to the comparatively wide river-bed strewn with huge water-worn boulders. The vegetation along this valley is varied and full of interest. Being at an elevation of approximately 2,650 feet, and having a plentiful supply of water from several small meandering creeks fed by the melting snow, the growth was luxuriant, especially along the sides of the creek where the plants obtained abundant light.

Farther down Sisters Creek the valley became more open, and the woods afforded suitable habitats for many species of plants which formed a similar plant association to that found about five miles up the Cheakamus Valley.

About half-past 4 a halt was made for the night at an altitude of 1,500 feet. The remainder of the day we spent in botanizing in the open woods in the vicinity of the camp and in pressing specimens.

On the fourth day we completed the remaining nine miles via Sisters Creek to Capilano, and one of the most noticeable features during the latter part of the journey was the frequent occurrence of *Taxus brevifolia* (yew). Isolated specimens of this tree are occasionally found, but on the slopes of Hollyburn Ridge they are comparatively common. (Hollyburn Ridge, it may be mentioned, is bounded by the Capilano and Sisters Creeks.)

Summary.

In addition to our success in securing specimens of the desired *Geum* in fruit, besides a few other unrecorded specimens for the vicinity of Vancouver, the exploration of the "The Lions" region supplied an excellent example of a similar environment producing a similar flora.

The valley of Sisters Creek duplicates, on a small scale, the valley of the Cheakamus opposite Mount Garibaldi. In both instances the substratum is composed of a fine silt and gravel, affording free drainage. The Cheakamus is fed by the melting snow and glaciers on the many peaks on both sides of its valley. Sisters Creek is fed from the melting snow on "The Lions," which usually have snow on them all the year round. Even at the time of our visit, towards the end of August, there were large, deep patches of snow on the summit and on some of the slopes, in spite of the fact that during the previous winter the snowfall was abnormally light.

Plants common to both valleys are *Thuja plicata* (white cedar), *Pseudotsuga Douglasii* (Douglas fir), *Tsuga heterophylla* (hemlock), *Alnus rubra* (red alder), *Acer circinata* (vine-maple), *Fatsia horrida* (Devil's-club)—constituting in some places the predominant underbrush competing with *Vaccinium ovalifolium* and *Vaccinium macrophyllum*.

Towards the margin of the bush, where more light is admitted, the ground is carpeted with *Rubus pedatus*, *Linnæa borealis longiflora*, *Clintonia uniflora*, *Tiarella trifoliata* and *T. unifoliata* (common), with an abundance of *Polystichum munitum* and *Asplenium felix-fœmina*.

Grasses are conspicuous by their rarity, except on some parts of Pemberton Trail where they have been introduced by horses.

It was also interesting to find several alpine plants common to the mountains of the Garibaldi region and those in the region of "The Lions," such as *Phlox Douglasii*, *Loiseleuria procumbens*, and *Emtrum nigrum*.

Other species could be added, but the above are those plants which have not yet been recorded from the neighbouring series of mountains in this vicinity. Several additions have thus been made to our knowledge of the flora of the Vancouver District.

The specimens of *Geum* collected on "The Lions" have since been carefully studied in relation to their most closely allied species, and the result may be of some importance in showing a closer relationship between *Geum radiatum* and *Geum calthifolium* than is generally shown in floras dealing with those two species.

Professor P.A. Rydbergs work on the genus *Sievisrsia*, in the North American Flora—a work which, when completed, will probably be the most comprehensive flora on this continent—has been of great assistance in determining the true position of our specimens.

The simplest plan would have been to describe our specimen as a new species, pointing out the difference from (1) *G. calthifolium* in the size and shape of the petals (the flowers being 3 cm. in diameter) and in a few minor points of difference in the leaves, etc., and from (2) *G. radiatum*, in the shape of the bractlets, size of flower, and pubescence of style; at the same time pointing out its relationship to *G. peckii* by its large flowers, scant pubescence, occasionally open sinus, and in the pubescence of the style.

The description of our plant as a new species would only add further confusion to that already existing in our floras, but it would have been the easiest way of disposing of this new form, thus leaving it for future botanists to show that the so-called differences between *G. radiatum* and *G. calthifolium* have practically broken down, and that *Geum Peckii* must again be regarded as a variety of *G. radiatum*—nothing more.

No doubt a careful study of the variation of *G. Peckii* will result in the breaking-down of some of the points of distinction between it and *G. radiatum*. The tendency to describe every little variation as a new species can only be accounted for by a lack of observation on the effect of environment on the plant.

If *Geum radiatum* presents certain morphological characters when grown in a region east of the Rocky Mountains where there is a limited rainfall, it would be surprising if these characters remained unaltered when growth in a region near the Pacific Coast where there is much greater precipitation the winter less severe, with abundant vegetation affording shade, shelter, and a greater amount of humus.

Such an environment results in the plants becoming less hirsute, and suggests that a similar environment in the Eastern States may account for the more or less glabrous form which has been described as *Geum Peckii*, and which, it appears, has only been found in the mountains in Maine and New Hampshire.

Professor Greene's belief that our plant is more closely related to *G. Peckii* than to *G. calthifolium* is very significant, especially in view of the fact that, after a careful analysis of *G. radiatum*, *G. calthifolium*, and *G. Peckii*, our specimens unite the two former, and show a close relationship to the latter. This also tends to show that Dr. W.J. Hooker, in his "Flora Boreali Americana," was right in regarding our Western plant as *G. radiatum* in spite of the fact that other floras place his *G. radiatum* as a synonym of *G. calthifolium*. *G. radiatum* (Michx.) is the earliest name and has precedence over *G. calthifolium*.



Fig. 44. Indian woman digging roots in Upper Botanie Valley.

[Larger [Image](#)]

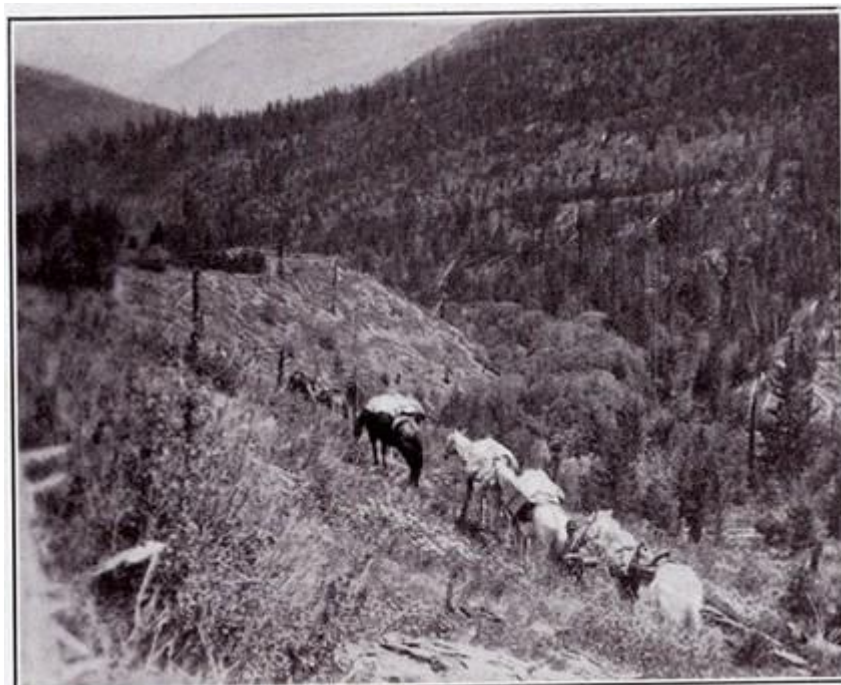


Fig. 45. On the return journey near headwaters of Murray Creek.

[Larger [Image](#)]

Fig. 46. Analysis of Geum.

	Geum Peckii	Geum radiatum	Geum calthifolium	“Lions” specimens.
Stem	Glabrous	Hirsute	More or less hirsute	Puberulent and sparsely hirsute
Petiole	Glabrous or sparingly ciliate	Hirsute	More or less hirsute	Puberulent and sparsely hirsute
Leaves	Round-reniform with truncate base, glabrous shining 3-5 palmately round-lobed	Reniform, short hairy above, long hirsute beneath, especially on the veins; obscurely lobed	Broad, round-reniform, more or less hirsute, at least on veins; 7 rounded lobes	Thin round-reniform-obscurely appressed, pubescent above, more or less hirsute beneath, especially on the veins. From very obscurely lobed to 7 rounded lobes
Margin	Doubly-dentate	Sharply doubly-dentate	Crenate-dentate	Doubly crenate-dentate
Sinus	Open	Narrow	Narrow	Rounded to narrow
Lateral leaflets	Obovate, cuneate, or ovate, 5-20mm. long	Lanceolate, minute, less than 5mm.	Very small 2-6 in number	2-5 in number, ovate to oblong, 1-6 mm. long, more or less toothed or lobed
Stem leaves	Blades united to stipules, ovate or lanceolate, acute	Sessile, obovate, rounded at apex	Sessile, clasping incised-lobed	Sessile, obovate, apex rounded, incised-dentate
Hypanthium	1 cm. high and broad(extraordinary size. J.D.)	4 mm. high, 6 mm. broad	Broadly obconic	3 mm. high, 5 mm. broad
Bractlets	Linear-subulate, 3 mm. long	Linear-subulate, 3-5 mm. long	Oblong or elliptic, 3-4 mm. long	Triangular-ovate to lanceolate, 3-4 mm. long
Sepals	5-8 mm. long, ovate, acuminate	8-10 mm. long, lanceolate-ovate, acuminate	Triangular-ovate to lanceolate-ovate, acute, more or less toothed	Oblong-lanceolate to ovate-lanceolate, nearly acuminate, 7 mm. long
Petal, size	10-15 mm.	10 mm.	8-10 mm.	13mm. (flower 3 cm. diameter).
Petals	Rounded-obovate, apex rounded or merely emarginate	Broadly obcordate	Broadly obovate, apex rounded or retuse	Broadly obcordate
Style	Hairy one-half or two-thirds length	Plumose at base only	Hairy more than half their length	Hairy two-thirds – three-quarters their length

Dr. Hooker remarks that his *G. radiatum* is closely related to *G. Peckii*. It is therefore not safe to assume that, because the latter has only been recorded from a few localities in the mountains of the Eastern States, it does not exist on mountains farther west. Mountains are often the last places to be explored, and much of our knowledge of the distribution and relationships of plants has been obtained through the study of mountain species.

The accompanying analysis has been prepared mostly from the descriptions given in the “North American Flora” and by a description of the corresponding characters exhibited in the specimens obtained on “The Lions.” ([Fig. 46](#))

Those parts of the analysis surrounded by a dark line indicate where our specimens are related to each particular species. In cases where our specimens are intermediate, it is shown by connecting the characters of two or three species, as the case may be. It will be seen that a description of our plant would tend to include some forms of *G. radiatum*, *G. calthifolium*, and possibly some of *G. Peckii*.

(9.) Botanical Survey of the Garibaldi Mountain Region.

The botanical survey of this region was continued from July 26th to August 9th, when new areas were explored, several additions made to the collections of the previous two years, and further information was obtained regarding the distribution of species.

Future exploration of this part of the Province will necessitate the selection of another centre for camp headquarters, as most of the country within a day's journey of the Black Tusk Camp has been visited. ([Fig. 47](#))

New ground from which specimens have been secured include the region adjacent to Sphinx Glacier and Castletower's Ridge, and a stretch of country lying north-north-east of Black Tusk. (See map opposite [page 16, Report 1.](#))

Empetrum Peak and Ridge. ([Fig. 51.](#))

On July 28th a visit was made accompanied by three members of the British Columbia Mountaineering Club Camp, to the range of mountains forming the west side of Helmet Valley. To the north of Black Tusk lies a large glacier filling the head of a deep Valley, the sides of which are composed of loose rocks — a kind of scree. A huge moraine separates this valley from Helmet Valley, and at the time of our visit the northern slopes of this moraine were mostly covered with snow. Bare patches here and there were of such a loose and porous nature that no vegetation could get a hold. The top of the divide between the two valleys 925 feet above the camp (approximate altitude, 6,025 feet above sea-level).

Following this divide one comes to the southern slopes of the above-mentioned range; these support a good covering of “grassy” vegetation containing a liberal supply of lupines, *Arnica*, *Erythronium*, *Castilleja*, and other showy flowering plants, with here and there thickets of black hemlock (*Tsuga Mertensiana*) from 2 to 5 feet high. Above this (6,400 feet) there are no trees on this range, the top of the mountain having a good coat of short vegetation forming a kind of sward in which many dwarf forms of plants were found. The Indian paintbrush — from one to two feet at 5,000 to 5,800 feet altitude—was found in flower on plants 2 or 3 inches high. Several species found on this range had not previously been found on other peaks in this region.

The underlying rock is different from that on Panorama Ridge, being of a more granitic nature; some sides (N.) present perpendicular precipices. At 6,500 feet the top is undulating, and from a botanical point of view is very interesting.



Fig.47 Camp at Garibaldi. (Note plant-presser drying in the sun.)

[Larger [Image](#) — Larger reversed [Image](#)]



Fig. 48. The floriferous zone between 5,000 and 5,500 feet on Black Tusk slopes.

[Larger [Image](#) — Larger coloured, detail [Image](#)]

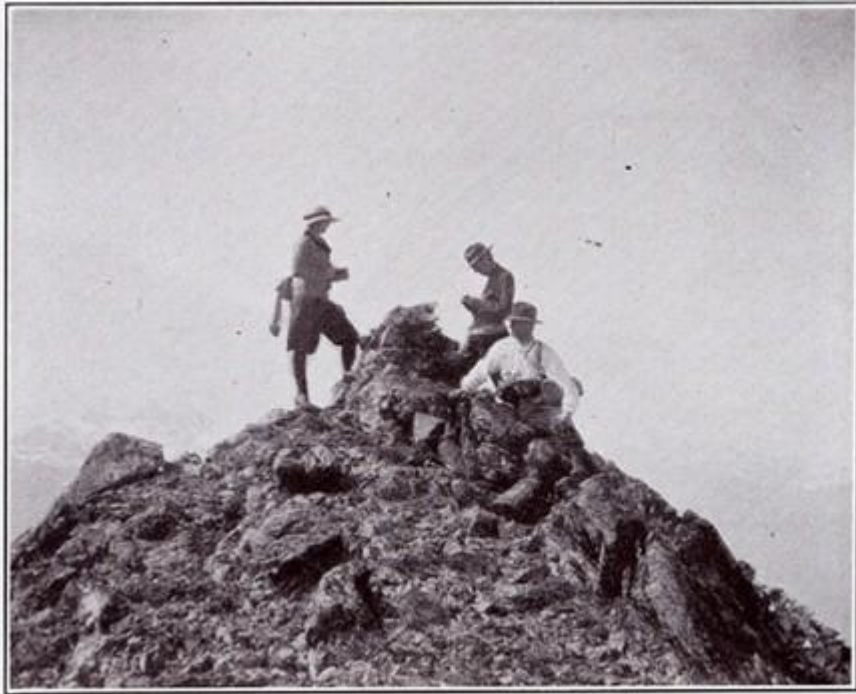


Fig. 49. Summit of Empetrum Peak (6,650 feet altitude).

[[Larger Image](#)]



Fig. 50. Summit of East Bluff of Black Tusk (6,600 feet).

[[Larger Image](#) — Larger, coloured [Image](#)]

The extreme summit rises to a small peak (approximate altitude, 6,650 feet) which is the highest on the range between Black tusk and the end of Helmet Valley. Near the summit a few specimens of *Empetrum nigrum* (crowberry) were found ; being a rare plant in this region, and being only found near the summit, the peak was named “*Empetrum Peak*” (6,250 feet), and is referred to under that name throughout the report. ([Fig. 49](#))

The range of lower mountains whose summits average 5,700 feet, and which form a ridge running north-east between Helmet Valley and Cheakamus Valley, was named “*Empetrum Ridge*”—after the dominant peak; it is not likely that these names are duplicated in any other part of Canada.

As this region was previously unexplored, the mountains were without names, and for the purpose of botanical survey-work they were named so that the localities of the specimens could be recorded.

On the 29th a trip was made along *Empetrum Ridge* almost to the north end. The lower slopes are well wooded, and in places a dense growth of underbrush makes it difficult to penetrate. Higher up, this gave way to a dense covering of scrubby black hemlock (*Tsuga Mertensiana*), above which the country was comparatively open and “grassy,” with frequent large patches of snow and occasional clumps of *Abies*.

On the lower slopes *Ribes Howellii* was very abundant, associated with *Rhododendron albiflorum* and an abundance of *Veratrum viride*. In the more moist situations *Saxifraga punctata* was profuse, and on the open-wooded south-eastern slopes, a gorgeous display of many coloured flowers was given by *Senecio triangularis*, *Potentilla flabellifolia*, *Arnica latifolia*, *Erigeron salsuginosus*, *Lupinus arcticus*?, *Valeriana sitchensis*, *Erythronium parviflorum*, *Spiræa pectinata*, *Parnassia fimbriata*, and *Habenaria dilatata*, with a few scattered specimens of *Castilleja miniata* and *C. angustifolia*.

Such an association as the above is characteristic of the south-eastern and south-western slopes of most of the mountains in this region at an altitude of 5,000 to 5,500 feet. One may occasionally find a stray specimen of *Aster foliaceus* or clumps of *Bryanthus emepriiformis*, but such specimens do not belong to this association.

Above this floriferous region one comes to the short “grassy” sward composed of grasses, sedges, and rushes. There are few trees to afford shade from the sun’s rays, which are hot in these alpine regions, or protection from the from time winds blowing off the glaciers, consequently time vegetation is stunted; clumps of *Juniperus communis Montana* and a dwarf juniper-like growth of black hemlock are the only conspicuous plants above 6,000 feet. In some places large areas are covered with a stunted growth of *CasisiopMertensiana*, *Bryanthus glanduliflorus*, and *B. empetriiformis*, with occasional clumps of *Carex nigricans*, *C. festiva*, and a few alpine grasses such as *Poa alpine*, etc.

On the highest part of the ridge, in time immediate vicinity of *Empetrum Peak*, *Anemone parviflora* and *Amemone multifida* were fairly common on a limited area; these had not been found on any of the neighbouring mountains, and on this peak they were associated with several of the rarer plants in this region such as *Saxifraga nivalis* and *Empetrum nigrum*. Lower down on the slopes of the moraine between Black Tusk and *Empetrum Peak* *Crepis nana* was very abundant. These species, though common in other parts of the Province, are rare in this region. *Anemone multifida* was very dwarf---only a few inches in height when in fruit.

Black Tusk

The actual summit (7,350 feet) rises precipitously for about 800 feet from an area which is practically surrounded by glaciers and snow-fields. Round the base of the precipices there is a huge deposit of scree composed of sharp-cornered rocks from 3 to 6 inches square; in this

scree no vegetation an exist. The “Tusk“ itself is of volcanic origin. A long ridge runs south-west from Black Tusk, and although the lower part of this ridge has also a deposit of scree, the upper part seems to have weathered more, and the rocks are more or less embedded in a fine muddy silt of a dark-grey, almost black, colour, corresponding to the colour of the surrounding rocks.

Amongst the first plants to obtain a hold of such a habitat are those with a deep root system, and whose leaves and stems form large compact tufts, such as:—

Carex nigricans
Carex Pyrenaica
Silene acaulis
Potentilla villosa

Sibbaldia procumbens
Phlox Douglasii
Phacelia sericea
Aplopappus Lyallii

The flora is chiefly composed of the last six species, but these are so sparse that from a distance the whole summit of the ridge looks absolutely barren.

The East Bluff (6,600 feet) is of a different geological formation,—evidently sedimentary. ‘The whole summit between the East and West Bluffs is covered by a deep layer of thin flat rocks, like large slates, but of a reddish or grey to almost white colour, from a distance appearing like snow. ([Fig. 50.](#))

In some places the sharp edges of these plates are exposed; this is most noticeable on the top. On the sides these are piled one above another, and, as it is necessary to climb about 800 feet over these loose slabs, it is both difficult and not altogether free from danger. These slabs vary in size up to 3 or 4 feet in diameter and from 1 to 4 inches thick. Sometimes when one is stepped on it is overbalanced and goes rattling to the bottom, displacing others during its descent. On such slopes we find no plant-life, further than a few lichens on the surface of slabs near the top.

It was surprising to find on the summit of the East Bluff that one or two species had been able to establish themselves. *Carex nigricans* seemed to grow in tufts amongst the loose plates, but it was found that some silt had accumulated at a point where the rock had not disintegrated and where the plates were set on edge. Nevertheless, the xerophytic nature of this species was forcibly illustrated. In similar habitats specimens were found of *Bryanthus glanduliflorus*, *Juniperus communis* Montana, and *Pentstemon confertus* var. *cærulea-purpureus*, and these constituted the total flora of the East Bluff.

Between the East and West Bluffs runs a ridge wholly composed of this loose sedimentary rock. At one place water from the melting snow on the north-west glacier runs down the south-west slopes of Black Tusk. At this point a considerable amount of silt fills the inter-spaces between the rocks, and provides what appears to be a suitable substratum for many plants, but only one species was found in this habitat—*Saxifrage Tolmiea*. Here it grew vigorously within a few feet of the glacier and in close proximity to the ice-cold water. All specimens of this species found in this region occupied similar habitats near glaciers or water from snow-fields. Its cold-resisting powers evidently enables it to grow where it is too cold for its competitors.

The West Bluff also appears to be of volcanic origin, as in its vicinity was found scree similar to that around the base of Black Tusk. One often finds small five-or-six-sided columnar portions of rock (columnar andesite) over 12 inches long by 3 or 4 inches in diameter; these, in falling, break up into scree. On the ledges left by these columns, sufficient soil accumulates by the weathering of the rock to afford a foothold for plants of *Pentstemon Menziesii*. These at first sight appeared to be growing on the bare rock, but it was found on examining some large clumps that the roots had got down behind loosened columns and by a mass of roots and soil helped to keep the columns from falling away. On removing one or two of the columns by means of an ice-axe and extensive root system was exposed.



Fig. 51. Helmet Valley, looking north to Empetrum Ridge.

[Larger Image, ([Left](#)) — ([Right](#))]



Fig. 52. Looking south from Black Tusk---Panorama Ridge in foreground, with Helmet Glacier filling the north-east valley, Mount Garibaldi on the right, Castletowers on the left, Sphinx Glacier between Castletowers and the head of Garibaldi Lake. (Photo by W. Gray.)

Descending to an altitude of about 5,800 feet, one comes into a zone of *Cassiope Mertensiana* and *Bryanthus glanduliflorus*, with a few scraggy specimens of *B. empetriformis*. On these slopes were found our first specimens of *B. intermedius*, which is believed to be a hybrid between the two latter.

A little lower (5,500 feet) one enters the floriferous zone of the south-west slopes, including all those species mentioned as found on the slopes of Empetrum Ridge, but having the following in addition—([Fig. 48](#)) :—

<i>Phleum alpinum</i>	<i>Heracleum lanatum</i>
<i>Trisetum spicatum</i>	<i>Vaccinium cæspitosum</i>
<i>Juncus Mertensianus</i>	<i>Pentstemon confertus</i> var. <i>cærulea purpureus</i>
<i>Juncus tenuis</i> var. <i>secundus</i>	<i>Mimulus Lewisii</i>
<i>Carex Mertensii</i>	<i>Mimulus alpina</i>
<i>Habenaria gracilis</i>	<i>Veronica alpina</i>
<i>Tofieldia glutinosa</i>	<i>Castilleja pallescens</i>
<i>Claytonia caroliniana</i> var. <i>sessilifolia</i>	<i>Pedicularis bracteosus</i>
<i>Stellaria borealis</i>	<i>Solidago multiradiata</i>
<i>Aquilegia Formosa</i>	<i>Arnica lævigata</i>
<i>Caltha leptosepala</i>	<i>Arnica alpina</i>
<i>Trollius albiflorus</i>	<i>Arnica cordifolia</i>
<i>Anemone occidentalis</i>	<i>Troximon aurantiacum</i>
<i>Leptarrhena amplexifolia</i>	<i>Troximon glaucum</i> var. <i>dasycephalum</i>
<i>Potentilla dissecta</i>	<i>Troximon glaucum</i> var. <i>parviflorum</i>
<i>Epilobium alpinum</i>	<i>Hieracium gracile</i>
<i>Osmorrhiza nuda</i>	

It will be seen that on these slopes the flora is rich and varied; and botanists familiar with such association of species can tell that the slopes have a covering of good soil, abundance of moisture, and exposure to the south or south-west, and are more or less sheltered from cold winds.

These slopes, being fairly open and exposed to the sun, present a mass of bloom long before the opposite northern slopes of Panorama Ridge, or even the plateau—several hundred feet lower—have got rid of their winter's coat. This supplied a magnificent illustration to students of the botany class, showing how one side of a mountain supports a totally different flora from that borne on the opposite side. It also served to show the value of vegetation in protecting the mountain-slopes from erosion, by acting as a gigantic sponge, absorbing the water and preventing the washing-away of the soil.

Panorama Ridge. ([Fig. 52.](#))

This ridge runs for two miles east of the camp headquarters. (See map, page 16, Report I.) The slopes are comparatively steep and rocky, especially on the western and southern sides. The summit of Helmet Glacier rises almost to the summit of Panorama Ridge, and covers practically the whole of the northern slopes, with the result that little vegetation can grow there.

The top of the ridge is approximately one mile long—that is, from the western to the eastern peaks—but owing to its undulating nature and an intervening central peak, a much greater distance is covered than that shown on the map. The western peak is approximately 6,350 feet; the centre peak, 6,675 feet; the eastern peak about the same, if not slightly higher.

The whole summit above 5,700 feet is open, the last of the trees—a low scrubby growth of *Tsuga Mertensiana*—being found on the south slopes at that altitude. Above this, clumps of *Juniperus communis montana* were found, but only towards the south and west sides.

It was interesting to observe the difference in the flora of Panorama Ridge compared with the other mountains in this region; various factors played a part in creating quite a different environment. The southern slopes of the ridge were so steep—in places forming precipices of rapidly disintegrating rock—that they could not carry a heavy coat of snow; consequently when the warm season returned the snow soon melted and trickled away through the rock-slides forming the base of the slopes. Most of the melted snow on the actual summit either soaked down into the loose rocks or was temporarily dammed into small pools which occasionally found an outlet on the north side towards Helmet Glacier.

In the open valleys between the peaks, where these pools had been formed, one found a short growth of vegetation composed chiefly of carices and alpine grasses, including:—

<i>Agrostis humilis</i>	<i>Carex nigricans</i>
<i>Aira atropurpurea</i>	<i>Carex Pyrenaica</i>
<i>Trisetum spicatum</i>	<i>Luzula spicata</i>
<i>Poa alpina</i>	

In some places a low growth of *Spiræa pectinata* carpeted the ground, in association with some or all of the above grasses and sedges. In this carpet the following plants were found, some in large patches, others scattered throughout:—

<i>Vaccinium cæspitosum</i> (patches)	<i>Bryanthus glanduliflorus</i> (patches)
<i>Potentilla villosa</i> (clumps)	<i>Phlox Douglasii</i> (patches)
<i>Potentilla dissecta</i> (scattered)	<i>Aplopappus Lyallii</i> (scattered)
<i>Sibbaldia procumbens</i> (patches)	<i>Solidago multiradiata</i> (scattered)
<i>Salix nivalis</i> (patches)	

This constituted the flora of these small valleys at an altitude of about 6,000 feet. Above this the flora changed suddenly, owing to the loose and rocky nature of these slopes leading up to the summits of the peaks. Below this altitude the change was less sudden, due to a series of ledges or terraces which merge into each other at the south-west end of the ridge.

The peaks were characterized by their apparent barrenness, but a careful search revealed several interesting species, amongst which were the following:—

<i>Agrostis humilis</i>	<i>Sibbaldia procumbens</i>
<i>Aira atropurpurea</i>	<i>Phlox Douglasii</i>
<i>Luzula spicata</i>	<i>Phacelia sericea</i>
<i>Silene acaulis</i>	<i>Aplopappus Lyallii</i>
<i>Stellaria longipes</i> var. <i>lata</i>	<i>Antennaria lanata</i>
<i>Arenaria sajanensis</i>	<i>Artemisia norvegica</i> var. <i>longepedunculata</i>
<i>Draba alpine</i> var. <i>glacialis</i>	<i>Erigeron composites</i>
<i>Draba stellata</i> var. <i>nivalis</i>	<i>Erigeron composites</i> var. <i>discoideus</i>
<i>Potentilla villosa</i>	

On the eastern and south-eastern slopes of the ridge below 6,000 feet abundance of *Silene Macounii* is found. This plant is rather local; having been found in only two places in this region.

On the western and south-western end of the ridge below 6,000 feet is found a closer resemblance to the flora of the neighbouring mountains. On the higher and open situations *Sedum divergens* is prolific, so also is *Phlox Douglasii*, associated with *Pentstemon confertus* var. *cærulea-purpureus*, and these gradually merge into a zone not quite so floriferous as that seen on Black Tusk and Empetrum Ridge; but here were found many of the transition forms of lupine, from the dwarf, villous forms of the higher altitudes to the taller and less pubescent forms of the lower altitudes.

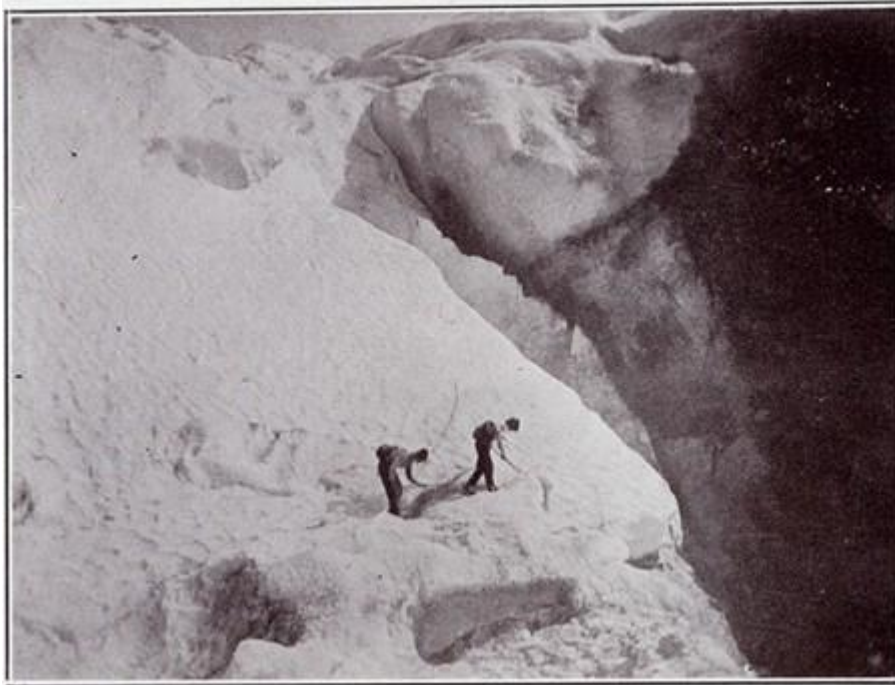


Fig. 53. On the edge of Sphinx Glacier.

[Larger coloured [Image](#)]



Fig. 54. Luxuriant growth of Saxifraga Tolmiea.

[Larger [Image](#)]

A little below 5,000 feet—that is, about 500 feet below timber-line in this region—is found in the open wooded slopes a quantity of *Lonicera cærulea*, this being the only locality in this region where it has been found. It grows in association with *Rhododendron albiflorum*; specimens were found the previous year in flower, and this year with the fruits almost mature.

Corrie Ridge.

This ridge lies about one mile east of Panorama Ridge, and is reached by descending from the latter by a gradual slope bearing sparse vegetation, becoming more dense near the bottom of the divide at an approximate altitude of 5,600 feet (about. 1,000 feet of a descent). The ascent of Corrie Ridge is steep and rocky, the rocks disintegrating so readily that some caution has to be taken in climbing.

The northern slopes are almost bare; being composed of much loose and crumbling rock, few opportunities are afforded for vegetation until near the summit (approximately 6,800 feet altitude), where there are numerous inhabited “nooks” and ledges. It was common to find small ledge entirely occupied by one species—e. g., *Silene acaulis*, or *Phacelia sericea*, etc. In two small “crannies” were found beautiful clumps of *Romanzoffia sitchensis*, this being the only locality in this region where it was found. A careful search revealed no more of it, though it is believed that there must be more in that neighbourhood.

From the peak or summit the ridge runs south in a more or less gradual slope to Garibaldi Lake, about two miles distant. Above 5,500 feet the slope is open; below this altitude it gradually becomes wooded. A comparatively narrow belt fringing the timber-line represents the characteristic floriferous zone, not quite so varied as on Black Tusk, but one in which *Veratrum viride*, *Heracleum lanatum*, and *Carduus edulis* are conspicuous. It is of interest to note that a similar environment—soil, exposure, and altitude—on one of the shoulders of Black Tusk shows almost identically the same species in similar proportions.

On the southern slopes some additions to last year’s collection were made, *Salix petrophila*, *Polygonum viviparum*, *Draba alpina gracilis*, and *Saxifraga cæspitosa* being added to those mentioned in last year’s report.

Castletowers Ridge and Sphinx Glacier. ([Fig. 52.](#))

As these lie several miles to the east of Black Tusk Camp, several mountains have to be crossed in order to reach them. This trip is considered a fairly strenuous one, and about as much as can be done on one day; especially when one has to stop to collect specimens, take notes or photos, and make observations on habitat, altitude, etc.

An early start was made one the morning of August 1st, accompanied by several members of the botanical section. It was decided to take the route via Helmet Glacier. This route was selected in order to avoid the necessity of crossing Panorama and Corrie Ridges—which had already been worked over—thereby saving a few hours on the journey. Helmet Glacier cover’s several miles of country at the head of Helmet Valley, and in order to reach Castletowers Ridge it was necessary to travel about two miles over ice. ([Fig. 53](#))

During our first visit in 1912 this glacier exhibited many crevasses varying in width up to 10 feet or more and in depth to 60 or 80 feet, but this year these were hidden under a layer of snow which had to be probed at every step. Abundant opportunities were afforded of seeing “red snow” like patches of blood—stains caused by the alga, *Hæmatococcus nivalis*.

The members of the party were, of course, roped together. At the margin of the glacier—where the ropes were adjusted—in Helmet Valley, *Saxifrage Toliea* grew most vigorously and abundant on ground which at one time had been covered by ice, but which now had a thick deposit of fine silt. ([Fig. 54.](#)) In this region also was found some specimens of *Artemisia norvegica longepedunculata*.

The glacier was crossed at a point between Corrie Ridge and Helmet Peak (see map), and this led to the steep slopes of the northern spur of Corrie Ridge. On these slopes the new additions were found this year.

Descending into Corrie Valley, the trip was continued due south, crossing the shoulder of Castletowers Ridge near Garibaldi Lake. ([Fig. 1, Report I.](#)) From the top of this there is a steep descent of about 2,000 feet to the tongue of Sphinx Glacier. The slopes here are densely wooded with large trees of *Tsuga Mertensiana* and some small *Pinus monticola*; the underbrush consisted chiefly of *Vaccinium ovalifolium* and *Rhododendron albiflorum*.

In the valley occupied by Sphinx Glacier are the remains of huge moraines, some fairly well covered with vegetation, others showing gradual transitions between them and those most recently formed. Near the tongue of the glacier there are many different environments, and it was interesting to observe the curious associations of plants in such an odd situation. Alpine and sub-alpine species were found growing together, constituting such a mixed collection as to make it impossible to ascertain what plant association is characteristic of such an environment.

In so far as this region is concerned, *Senecio Fremontii*, *Epilobium latifolium*, and *Lupinus arcticus*? are always associated together on the debris near the tongues of glaciers. At the north-east tongue of Helmet Glacier these are the only species in its proximity. Near the north-east glacier of Black Tusk these constitute the predominant species, but, though they were again found associated near Sphinx Glacier, the encroachment of other species on this habitat showed that certain factors had to be taken into account which evidently played no part in the two other situations mentioned.

In the first instance, the altitude here is approximately 4,600 feet—which is given as the elevation of Garibaldi Lake—compared with 5,500 feet at Helmet and Black Tusk Glaciers. This difference of 900 feet may at first sight not account for such a difference in the flora, but it will be remembered that the floriferous zone is situated between those two altitudes, and the intruders near Sphinx Glacier Were mostly plants from this zone. About one-half of these plants are adapted for wind distribution, but, as there is in that vicinity a wide belt of densely wooded country, this would interfere with the distribution of seeds if the wind happened to blow from the north; but it so happened that this area was more exposed to winds from the south, and the country for several miles to the south is covered with glaciers and perpetual snow-fields. In short, it was evident from the first that wind was not an important agent in bringing the intruders from the higher altitudes to compete with what were believed to be the characteristic plants of this environment.

The journey was continued east for over a mile along the moraine at the edge of the glacier, and it was soon ascertained how the plants were brought down from the upper slopes. There was abundant evidence that huge avalanches are frequent during winter; this was illustrated by the deposition of heaps of debris on the glaciers, having in some cases been carried several hundred feet over the ice. In this debris were blocks of rock reaching almost 8 feet in diameter; whole trees were also torn up and strewn over the glacier in several localities. This explained the presence of similar deposits found between the base of the slopes and the glacier, and left no doubt as to how the flora in the region of Sphinx Glacier became such a miscellaneous collection.

From Sphinx Glacier an ascent was made of the south-west slopes of Castletowers Ridge to an altitude of over 7,000 feet. During this ascent the tracks of several avalanches had to be crossed, and the hundreds of fallen and broken trees presented a fairly good illustration of the devastating effect of this factor in the distribution of plants.

Near the brow of the ridge (6,000 feet) was found an area in which dwarf specimens of *Campanula rotundifolia* were profuse; in one or two habitats they reached a height of 8 inches, but on the whole did not exceed 3 or 4 inches. These were found frequently up to an altitude of 7,000 feet in the vicinity of a steep rock-slide, on searching which we were rewarded by numerous clumps of *Polemonium confertum* growing between the huge boulders which cover the surface of the slide.

On the return journey more specimens of *Silene Macounii* and *Pentstemon Menziesii* were found abundant on a southern exposure near the headwaters of a creek which finds an outlet into Sphinx Valley. The latter species, though common within a few miles of Vancouver, is rather rare in the Garibaldi region.

Summary.

The botanical survey of the Garibaldi Mountain region has resulted in revealing the presence of an extensive alpine region in close proximity to Vancouver, and which on completion of the Pacific Great Eastern Railway may be reached in one day from that city.

The region to the north of Mount Garibaldi was previously unknown, and as far as can be ascertained the first person to enter it was Mr. William Gray in 1912, when he went in to select a suitable location as a base for the British Columbia Mountaineering Camp.

Since 1912 this region has been thoroughly explored, and much scientific data has been obtained. A contribution to the geology of the region has been given by Dr. E.M. Burwash and published in the *Journal of Geology*, Vol. XXII., No. 3, April- May, 1914. Some work on the fauna has been done by various members of the Mountaineering Club, and a list of the mammals and Lepidoptera found there will no doubt be published in the next issue of the *Northern Cordilleran*.

The work in connection with the botanical survey of the region has been intensely interesting, and has supplied much material and data regarding the distribution of plants in the Province, many species being recorded that had not previously been found near Vancouver.

The collections made during the three visits are all incorporated in the Herbarium, and have already prompted research on some critical species. Several transition forms have helped to connect a few so-called species or varieties, and have cleared up some previously doubtful points which have been used in Western botanical works as reliable characters in the segregation or definition of species.

Field-study of the plants in relation to their alpine conditions—taking into account time altitude, exposure, soil, amid other factors which, when combined, constitute the plant's environment—gives one a wider idea and truer conception of what is meant by "species" than can be obtained from the study of isolated herbarium specimens.

Several of the forms found would by some botanists be regarded as distinct species, and if isolated specimens had been collected and sent to specialists, there is no doubt that the present confusion would have been increased by the description of several new species from this region.

By studying the plants in their relation to environment, not only do we come to a fuller knowledge of the variation within the limits of a single species, but it helps to show that several so-called species must ultimately be regarded as environmental forms; when this is done it will greatly help to clear up the existing chaos in some of our Western genera.

The following list is given as a contribution to the flora of the Garibaldi region, and from it one can judge how interesting this part of the Province is. The list is by no means intended to be a complete one, as it is practically a list of the plants collected during the three visits which were made towards the end of July and the beginning of August in the years 1912-14.

Contribution to the Flora of British Columbia (Garibaldi Mountain Region).

Woodsia scopulina, Eaton.

(Glabrous variety.) The Garibaldi specimens have the deeply cleft lacinate scaly indusium of *W. scopulina*, but have the smooth glabrous frond of *W. oregano*. (This intermediate form tends to connect *W. scopulina* with *W. oregano*. Collectors should be on the look-out for specimens of *W. scopulina* with a minute indusium composed of a few beaded hairs.) North-east slopes of Black Tusk.

Asplenium Trichmanes, Linn.

Between Stony Creek and Cheakamus.

Cryptogramma acrostichoides, R. Br.

On rock-slides along Pemberton Trail and Stony Creek up above 3,000 feet. Common.

Botrychium ternatum, Schwartz.

In open woods about four miles up Pemberton Trail. Rare.

Equisetum hyemale, A. Br.

By Pemberton Trail.

Lycopodium clavatum, Linn.

Common on slopes from Stony Creek up to 2,500 feet.

Lycopodium selago, Linn.

One or two specimens found on Gentain Ridge near Castletowers, and also on slopes near Mimulus Creek.

Lycopodium sitchense, Rupr.

Rock-slide on trail from Stony Creek to camp, and near Garibaldi Lake.

Lycopodium alpinum, Linn.

Rock-slide on trail from Stony Creek to camp; Castletowers Ridge; Panorama Ridge.

Lycopodium annotinum, Linn.

Near Garibaldi Lake, near Mimulus Creek, ten miles north of Squamish.

Pinus monticola, Dougl.

On Pemberton Trail. Common near Stony Creek. ([Fig. 55.](#))

Tsuga Mertensiana, Carr.

Common from 3,000 to 5,000 feet.

Abies lasiocarpa (Hook), Nutt. ([Figs 56, 57.](#))

This species has been recorded for various parts of the Province as *Abies subalpina* (Engl.), which is a synonym.

In connection with the classification of our specimens, some interesting points have been brought out.

In the first place, the cones were only about 1 inch long, instead of from 2-4 inches; so short that it was suggested our plant may be a new species. I am unwilling to accept this suggestion, because, after a careful search of several dozen mature cones, no fully formed seeds were found, and I concluded that the trees referred to, although well grown, have their cones stunted, probably due to the short growing season.

During our first visit in 1912 mature cones of *Abies* were found about 3 or 4 inches long, and as these agreed in size, shape, and most other characters of *Abies amabilis*—as supplied in our Western floras—they were referred to that species. But the cones being pubescent or puberulent (a characteristic of *Abies lasiocarpa*), I was a little doubtful until I observed in Sudworth's "Trees of the Pacific Slope" that in British Columbia *A. lasiocarpa* was chiefly

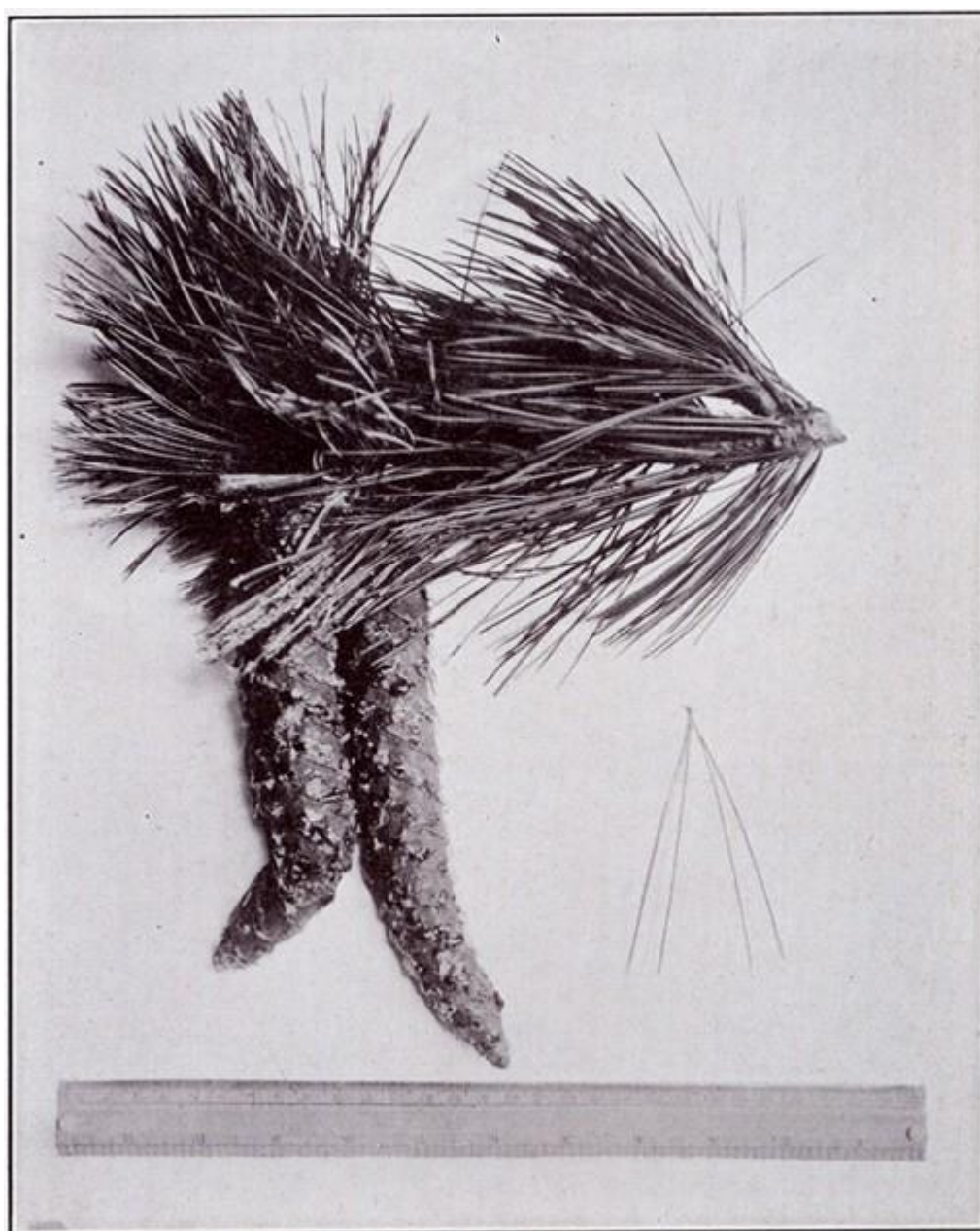


Fig. 55. *Pinus monticola*.



Fig. 56. *Abies lasiocarpa*. (The cones are stunted, being only 3-3 1/2 cm. long, producing no matured seeds.)

[Larger, reversed [Image](#)]

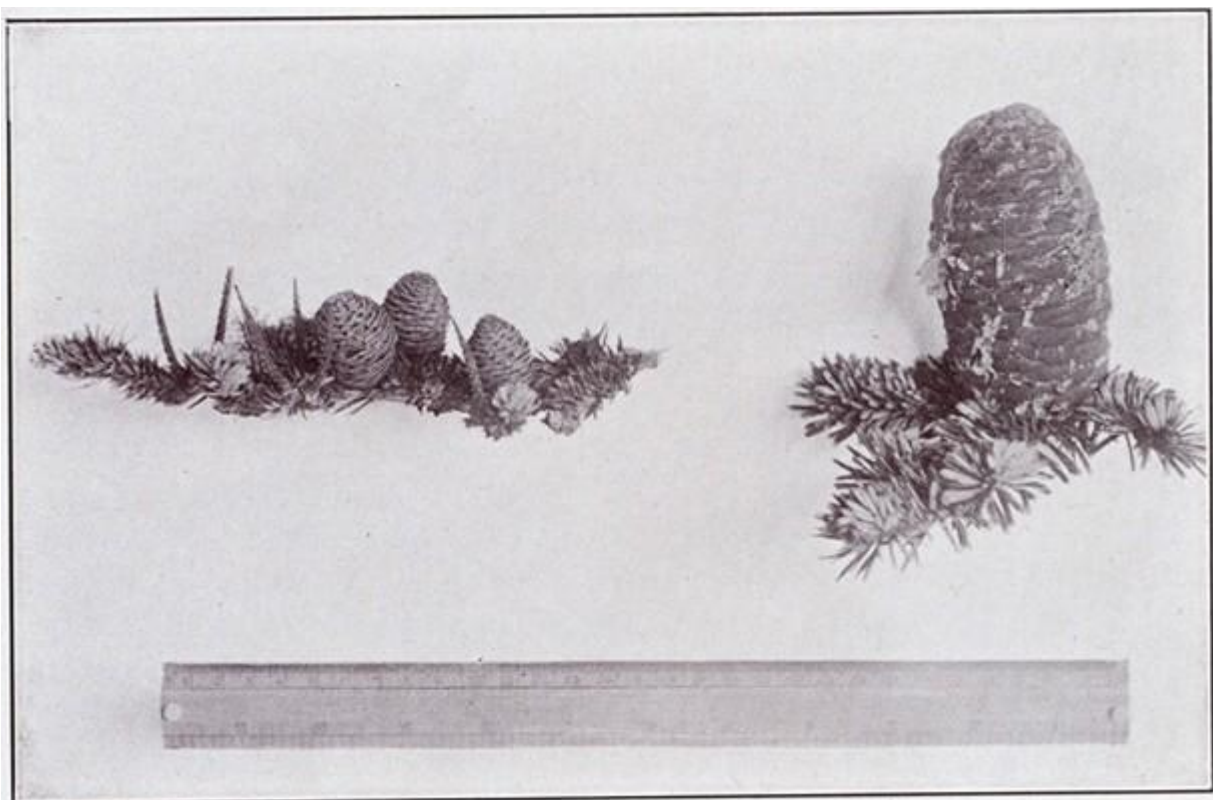


Fig. 57. Cones of *Abies lasiocarpa* (left), and *Abies amabilis* (right).

confined to the Rocky Mountains and “not on west slopes of Southern British Columbia Coast Range nor on Vancouver Island.” On the other hand, *A. amabilis* is given as found on the “Sea-side of Coast Range, recorded only from Queen Charlotte Islands, and a point opposite north end of Vancouver Island . . . on Dean or Salmon River, mountains of Fraser River (below Yale), also in Vancouver Island.” This seemed to indicate that our plants must be *A. amabilis*.

During the next two visits, 1913—14, no large cones were to be found, only small stunted ones.

In 1914 this was looked into minutely, and cones of *Abies amabilis* obtained from correspondents at Prince Rupert and Vancouver Island. These were compared with cones of *Abies amabilis* from our local mountains and with the Garibaldi specimens.

It was soon evident that either Saudworth erred in his geographical distribution, or that the characteristic differences between *Abies amabilis* and *A. lasiocarpa* given in our Western floras were unreliable. The result has shown that both were at fault.

Specimens of the Garibaldi small-coned *Abies* were sent to Professors E.L. Greene (National Museum) and C.S. Sargent (Arnold Arboretum), and in both cases it was referred to *A. lasiocarpa* on account of the puberulent cones. This, however, I did not consider a reliable character, because practically all our cones of *A. amabilis* were puberulent, some distinctly velvety, much more so than some of the cones of *A. lasiocarpa*.

I called Professor Sargent’s attention to this point, and he furnished another character which is not given in our floras—viz., that in *A. lasiocarpa* the stomata are abundant on the upper surface of the leaves, and in *A. amabilis* absent or rare.

This proves to be a point of considerable botanical importance; the difference under the microscope is very marked, and should be of value to botanists and foresters in determining the species even when cones are not obtainable.

It is of equal importance to know that the size and pubescence of the cones cannot be relied on as distinctive points.

With regard to the geographical range, it now extends to southern British Columbia near the west coast, and no doubt will soon be reported from other regions in this vicinity.

Abies amabilis appears to occur frequently in this region, several instances being known where they were mistaken for *A. grandis* until the purple cones were found on them. *A. amabilis* is well represented in the Garibaldi region.

Thuja plicata, Donn.

Common on lower slopes.

Chamæcyparis nutkaensis, Spach.

Pemberton Trail; Stony Lake.

Juniperus communis Montana, Ait.

Panorama Ridge, 6,000 feet; Gentain Ridge.

Sparganium simplex, Huds.

Near Pemberton Trail.

Phleum alpinum, Linn.

Crater Lake; Black Tusk; Helmet Valley.

Agrostis humilis, Vasey.

Panorama Ridge.

Aira atropurpurea, Wahl.

Corresponds with description of *Deschampsia atropurpurea*, but has no prolongation of rachilla. *Aira* given as synonym of *D. atropurpurea*.

Trisetum spicatum, Linn.

Panorama Ridge; Black Tusk Valley; Helmet Valley.

Poa Lettermani, Vasey.

Specimens of this grass were brought down from near the summit of Mount Garibaldi by one of the botanical members of the British Columbia Mountaineering Club, Mr. Ernest Burns, who informed me that it was the last plant found during the ascent. Mount Garibaldi has an altitude of close on 9,000 feet. This constitutes a new record not only for British Columbia, but for Canada. (My determination of this species has been verified by Mr. M.O. Malte, Dominion Agrostologist; Prof. C.V. Piper and Professor A.S. Hitchcock, State Agrostologists, Wash., D.C.,

Poa alpina, Linn.

Panorama Ridge.

Poa laxa?, Hænke.

Specimens which I consider belong to this species were found in Helmet Valley at an altitude of approximately 5,400 feet. I endeavoured to have the identification verified by three above-mentioned specialists in grasses, and as a result received different specific names from each. By one it was considered to be near *Poa Olneyæ* or *P. Wheeleri*, another referred it to *P. saxatilis*, and the other referred it to *P. paddensis*. This was all the more interesting in as much as the same specimen was sent first to one, then to the others. On comparing our specimens again with the descriptions of the above species, I find that it comes nearest *Poa laxa*, whose range is given as "Washington to Alaska."

This is no reflection on the abilities of these botanists, who have rendered valuable service in this difficult section of the flora; but it serves as a good illustration of the necessity for full and accurate details in the descriptions of new species, a necessity which is by no means confined to grasses.

Carex festiva, Dewey.

Empetrum Ridge and near Garibaldi Lake.

Carex Mertensii, Prescott.

Between Lesser Garibaldi Lake and Garibaldi Lake; Stony Creek; Black Tusk slopes near Sphinx Glacier.

Carex nigricans, C.A. Meyer.

Black Tusk Valley. Common on Panorama Ridge.

Carex Pyrenaica, Wahl.

Near Garibaldi Camp; Panorama Ridge. This species may be often overlooked on account of its resemblance to young plants of *C. nigricans*.

Carex glareosa?, Wahl.

Two specimens collected for *C. alpina* near the camp came very near to this species. Two or three other carices were found, but were too immature to ascertain the species.

Juncus Mertensianus, Bong.

Between Garibaldi Lake and Lesser Garibaldi Lake; Black Tusk slopes; Helmet Valley.

Juncus tenuis var. *secundus*, Engelm.

Black Tusk; Lesser Garibaldi Lake.

Luzula spicata, DC.

Near Crater Lake; Panorama Ridge.

Corallorhiza Mertensiana, Bong.

Common on slopes above Stony Creek and by Pemberton Trail.

Habenaria orbiculata, Torr.

Pemberton Trail north of Swift Creek.

Habenaria dilatata, Hook.

Common on Black Tusk slopes.

Goodyera Menziesii, Lindl.

Common by Pemberton Trail and on slopes above Stony Creek.

Spiranthes Romanzoffiana, Cham.

Frequent around Brackendale.

Lilium columbianum, Hanson.

Near Garibaldi Lake on south-west slopes of Panorama Ridge.

Erythronium parviflorum, (S. Watts.), Gooding.

On slopes of Black Tusk and on slopes of Empetrum Ridge.

Veratrum viride, Ait.

Common from 3,000 up to 5,500 feet, on Black Tusk slopes; Empetrum, Castletowers, and Helmet Ridges,

Generally distributed.

Tofieldia glutinosa (Michx.), Pers.

Black Tusk Valley.

Smilacina sessilifolia, Nutt.

On lower slopes of Black Tusk near Stony Creek.

Maianthemum bifolium dilatatum, Wood.

Common along Pemberton Trail and on lower slopes of Black Tusk near Stony Creek.

Disporum oreganum (S. Watts.), Benth & Hook.

By Pemberton Trail.

Streptopus amplexifolius (Linn.), DC.

Near Mimulus Creek.

Streptopus roseus, Michx.

Near Mimulus Creek and on Empetrum Ridge.

Salix Scouleriana, Barratt.

Common along Pemberton Trail.

Salix Barclayi, Anders.

Common at base of Black Tusk slopes at 5,200 feet.

Salix commutata, Bebb.

Common near Black Tusk at 5,000 to 5,500 feet.

Salix petrophila, Rydb.

Corrie Ridge; Black Tusk; near Sphinx Glacier.

Salix nivalis, Hook.

Common on Black Tusk, Panorama Ridge, Castletowers Ridge, and Empetrum Peak, etc.,
at altitudes of 5,500 to over 6,000 feet ; near Sphinx Glacier.

Populus trichocarpa, Torr & Gray.

Common to the head of Stony Creek.

Alnus rubra, Bong.

Common along Pemberton Trail.

Alnus sitchensis (Regel.), Sargent.

Common on time lower slopes of the mountains.

Asarum caudatum, Lindl.

Common along Pemberton Trail; on lower slopes from Stony Creek to between 2,000 and 3,000 feet.

Oxyria digyna (Linn.), Hill.

Common on Stony Creek and throughout the higher regions up to between 5,000 and 6,000 feet; near Sphinx Glacier.

Polygonium viviparum, Linn.

Rather rare between Table and Red Mountain; Corrie Ridge.

Polygonum minimum, Wats.

By shore of Stony Lake. Locally common.

Claytonia sibirica, Linn.

Stony Creek and Pemberton Trail.

Claytonia caroliniana sessilifolia (Michx.), Torr. ([Fig. 13, Report I](#))

Common in vicinity of Black Tusk above 5,000 feet.

Silene acaulis, Linn. ([Fig. 15, Report I.](#))

Common on southern slopes of Black Tusk, Panorama Ridge, Castletowers, etc., at about 5,500 to 7,000 feet.

Silene Macounii, S. Watson.

Common on Panorama Ridge and on Castletowers Ridge.

Stellaria borealis, Bigel.

Black Tusk; Helmet Valley.

Stellaria longipes læta (Rich.), Wats.

Panorama Ridge.

Sagina Linnæi, Presl.

Garibaldi Camp; Stony Creek.

Arenaria sajanensis, Willd.

Panorama Ridge; near Sphinx Glacier.

Nuphar polysepalum, Engelm.

Starvation Lake (alt. 600 feet).

Caltha leptosepala, DC.

Black Tusk alp-lands and slopes.

Trollius albiflorus (Gray), Ryd.

Black Tusk slopes and alp-lands.

Actaea spicata arguta (Nutt.), Torr.

Pemberton Trail. Common.

Aquilegia formosa, Fischer.

Black Tusk slopes; Helmet Valley; round Garibaldi Lake; near Sphinx Glacier.

Anemone occidentalis, Wats. ([Fig. 18, Report I.](#))

Black Tusk slopes; near Helmet Glacier; Panorama and Corrie Ridges.

Anemone parviflora, Michx.

Empetrum Ridge.

Anemone multifida, Poir.

Empetrum Ridge.

Ranunculus Eschscholtzii, Schlecht.

Black Tusk slopes; Stony Lake near Helmet Lake (on divide).

Dicentra Formosa, DC.

Pemberton Trail. Common.

Corydalis glauca, Pursh.

Pemberton Trail near Stony Creek.

Cardamine oligosperma, Nutt.

Stony Lake; Black Tusk.

Draba alpina gracilis, Dickie.

Panorama Ridge amid north side of Corrie Ridge.

Draba stellata nivalis, Regel.

Black Tusk slopes; Panorama Ridge.

Arabis lyrata occidentalis, Wats.

Black Tusk slopes.

Radicula officinalis, R. Br.

Brackendale.

Radicula alpina, Wats.

By Stony Lake and between it and Lesser Garibaldi Lake.

Sedum divergens, Wats.

Common on Panorama Ridge.

Leparrhena amplexifolia (Sternb.), Ser.

Common on marshy alp-lands near Sphinx Glacier.

Saxifraga Lyallii, Engler.

Black Tusk slopes; Helmet Valley; slopes of Empetrum Ridge.

Saxifraga caespitosa, Linn.

Corrie Ridge.

Saxifraga nivalis, Linn.

Moraine near Sphinx Glacier; Empetrum Peak; Corrie Ridge.

Saxifraga bronchialis, Linn.

Pemberton Trail; Empetrum Ridge; Panorama Ridge; south slope of Sentinel Peak.

Saxifraga Tolmiea, Linn. ([Fig. 54.](#))

Abundant in Helmet Valley near the glacier.

Saxifraga punctata, Linn.

Helmet Valley; Black Tusk. (This I have referred to *S. punctata*. Our specimens agree with Professor Piper's description of *S. odontophylla*, and with Fischer and Meyers's description of *S. æstivalis*, but the "Index Kewensis" indicates the latter is equivalent to *S. punctata*, L. It seems that *S. odontophylla* may be but a variation of *S. punctata*.)

Saxifraga Mertensiana, Bong.

Panorama Ridge.

Saxifraga leucanthemifolia, Michx.

Stony Lake, Panorama Ridge, and Pemberton Trail.

Mitella pentandra, Hook.

Stony Lake; slopes to Garibaldi Lake.

Mitella Brewerii, Gray.

Panorama Ridge; Black Tusk; slopes round Garibaldi Lake.

Tiarella unifoliata, Hook.

Pemberton Trail; Garibaldi Lake; Stony Lake; slopes above Stony Lake.

Tiarella trifoliata, Linn.

Abundant along Pemberton Trail. (One specimen found was intermediate between the two above-mentioned species, showing two unifoliolate leaves and two trifoliolate, with the pubescence and acute calyx lobes of *T. trifoliata*.)

Parnassia fimbriata (Banks), Koenig.

Black Tusk slopes, Helmet Valley, etc.

Ribes Howellii, Greene.

Cheakamus; west side of Panorama Ridge; Helmet Valley; Empetrum Ridge.

Ribes lacustre (Pers.), Poir.

Common in Cheakamus Valley.

Ribes bractosum, Douglas.

Common in Cheakamus Valley.

Ribes divaricatum, Douglas.

Common in Cheakamus Valley.

Spiraea Menziesii, Hook.

Pemberton Trail.

Spiraea pectinata, T. & G.

Common throughout the region above 4,000 feet.

Aruncus sylvester, Kostel.

Frequent along Pemberton Trail.

Pyrus emarginata (Dougl.), Walp.

Common along Pemberton Trail.

Rubus leucodermis, Douglas.

Common along Pemberton Trail and by Stony Creek.

Rubus spectabilis, Pursh.

Common along Pemberton Trail and on lower slopes of mountains, etc.

Rubus nutkanus, Moc.

Common along Pemberton Trail, etc.

Rubus pedatus, Smith.

Common in woods of lower slopes.

Rubus ursinus, Cham. & Schlecht.

Common along Pemberton Trail, etc.

Potentilla villosa, Pall.

Helmet Valley; Black Tusk slopes; Panorama Ridge.

Potentilla flabellifolia, Hook.

Black Tusk slopes; Helmet Valley.

Potentilla dissecta, Pursh.

Panorama Ridge, common; Black Tusk slopes.

Sibbaldia procumbens, Linn.

Common above 5,500 feet. Panorama Ridge; Helmet Valley; near Stony Lake.

Geum macrophyllum, Willd.

Frequent along Pemberton Trail.

Lupinus arcticus, S. Watson (?). (Figs. [17](#), [58](#), [59](#).)

I have tentatively referred our specimens to this species pending further research on *L. nootkatensis*. This genus is one which, in so far as our Western species are concerned, requires to be more thoroughly studied in the field. It seems probable that several of our so-called "Western species" will yet turn out to be mere environmental forms of this polymorphic species.

From specimens collected during the first year it was thought that at least two species were represented; some agree with the description of *L. arcticus*, except that the keels are ciliated; *L. arcticus* is described as having a naked keel. Other specimens seemed to belong to an un-described species having characters which showed relationship to *L. nootkatensis*, *L. subalpinus*, and one or two other closely related species which differ from each other only by a few points of minor importance.

The field-study of this genus during 1914 was undertaken with the object of securing complete data concerning the supposed un-described lupine, and the result was the finding of every intermediate link connecting the two.

A splendid opportunity was afforded for studying the great variation in—what I now believe to be—a single species. The height of the plants, pubescence, size and form of leaflets, size and colour of flowers, and the ciliation of the keels varied so much in different specimens that practically every combination of characters was to be found in some of them. Much of the variation was directly due to habitat, and numerous transition forms prevented these being separated into distinct varieties.

Miss A. Eastwood, of the California Academy of Sciences, who has made a special study of this genus, recognized our specimens referred to as *L. arcticus*, but was not familiar with the taller and less villous specimens.

The ciliation of the keel was a point of great interest, as this is the only point of difference between our specimens and the description of *L. arcticus*. No specimens were found with the keel absolutely naked; most were distinctly ciliate, some markedly so, while others had only traces of ciliation.

If the ciliation of the keel is to be regarded as an infallible character then our plant is not *L. arcticus*; but from the range of variation exhibited in our series of specimens, one would not be surprised to find a specimen with no trace of ciliation. Further, *L. nootkatensis*, *L. subalpinus*, and other species may or may not have ciliated keels, and it is possible that *L. arcticus* had been described without any attempt to investigate its range of variation.

Several of our specimens come very near *L. nootkatensis*, and it is possible they may yet prove to belong to this species. If this turns out to be the case, it will also prove that several of the above-mentioned species are only environmental forms, or at most mere varieties of this species.

Of course, there is no reason why *L. nootkatensis* (usually looked on as a Coast plant) may not also be found in the mountains, especially in such a situation as the Garibaldi region, and in the mountains to the north of Vancouver, where this same lupine is found. It is common in various parts of the world to find maritime species associated with alpine or sub-alpine species, and instances of this are not unknown in British Columbia.

When the geology of the district is taken into account, there is good reason to believe that the Garibaldi specimens may prove to be *L. nootkatensis*.

Dr. F. Burwash has shown that this region was formed by volcanic action, during which the lavas have been deposited on a raised beach now between 2,000 and 3,000 feet above sea-level.

By a curious coincidence the lupines on Black Mountain near Vancouver and in the Garibaldi region appear at an altitude of approximately 3,000 feet, though in the Garibaldi region they are more abundant at an altitude of 5,500 feet, having been forced up by their more successful competitors of the lowlands.

Relation to Environment.

From a careful study of the conditions under which they grow, it is evident that these lupines readily respond to a change of environment. ([Fig. 58.](#))

In deep black soil with abundant moisture they grow about 2 feet high, the other parts in proportion. The leaflets are oblanceolate, varying from acute to obtuse, usually with a distinct mucro, though this may be absent.

In such a habitat the pubescence is sparsely villous or pilose, accompanied by a finer canescence. In the more moist, shady habitats the pilose hairs are absent and the plant becomes sparsely canescent to glabrate.

Compare this with the forms found on exposed slopes where few other plants can compete with them, such as in pockets, near the base of a rock-slide, with a south-west exposure. It is evident that its deep root system enables it to get sufficient moisture from what appears to be a dry and hot habitat. The plants in such a situation are only from 6-8 inches in height, the leaflets reduced in proportion, Some becoming obovate and obtuse; add to this the dense spreading villous pubescence—some plants being quite hoary—and we have a plant which no one at first sight would consider to be the same species as those found in the rich, moist, and shady habitats.

There are so many points of difference between the two extremes that they could be described as well-marked species; but the intermediate forms found around and adjacent to those two environments complete the series of transitions from one to the other, rendering it impossible for one familiar with the plants as they grow in field to separate them into more than environmental forms.

If a description was drawn up to include all these variations it is certain that several “species“ would be united together under one specific name. By doing this one might be able to retain the relationships, of the various lupines under varietal names, whereas at present, as soon as a lupine reaches a certain degree of variation, it becomes more closely “related“ to some other “species.”

A series of between thirty and forty specimens was obtained, and, from this, one is able to separate them into five groups, the plants in each group agreeing in certain characters, but characters which are so liable to vary as to be of no value as points upon which to segregate species.

The accompanying table shows the range of variation in the five groups, amid a considerable degree of variation is shown amongst the specimens of each group. ([Fig. 59.](#))



Fig. 58. The lupines as they grow in good soil in a sheltered situation with plenty of moisture on slopes of Black Tusk.
(Photo by W. Park.)

Fig. 59. Analysis of Garibaldi lupines

	Series 1	Series 2	Series 3	Series 4	Series 5
Stems—Height	3 – 3½ dm.	4 – 5 dm.	4 – 4½ dm.	3½ – 4 dm.	1-2 dm.
Stems—Pubescence	Double, sparsely puberulent, with few scattered appressed villous hairs	Appressed villous	Sparsely pilose	Double, finely puberulent, with a few scattered hairs	Appressed or widely spreading strigose-pilose pubescence
Leaves—Size	2-4½ cm. X 9mm.	4-6 cm. X 9-14 mm.	4-6 cm. X 8-14 mm.	4-6 cm. X 8-15 mm.	2-3½ cm. X 8-13 mm.
Leaves—Shape	Narrowly oblanceolate, acute, short mucronate	Oblanceolate to broadly oblanceolate; obtusish, short mucronate	Oblanceolate to broadly oblanceolate, acute, mucronate	Broadly oblong, cuneate base, retuse to obtuse or indistinctly mucronate	Obovate to oblanceolate, acute to obtuse, with or without a short mucronate tip
Leaves—Pubescence	Appressed pubescent beneath sparsely so above	Sparsely appressed pubescent beneath, less so above, appearing ciliate by long hairs near margins	Sparsely pilose below becoming glabrous above margin, markedly ciliate with long white hairs, 1-1½ mm. long	Appressed pubescent below, less so above	Hoary with rather long somewhat strigose pubescence, markedly siliate on margin of leaf
Peduncle	4-7 cm.	6-7 cm.	5½ – 8 cm.	6-7 cm.	1½ -4 cm.
Inflorescence	5-14 cm. long, many-flowered	7-9 cm., lax-flowered	8-12 cm., few to many flowered	10-12 cm., many-flowered	About 2 cm., few to many flowered
Pedicels	6 mm.	6-8 mm.	5-7 mm.	4-8 mm	3½ -4 mm.
Calyx—Ant. lobe	Bifid or slightly trifid	Bifid or slightly trifid	Entire, acute	Markedly trifid	Entire, acute
Calyx—Post. lobe	Bifid, slightly shorter than anterior	Bifid, slightly shorter than anterior	Bifid, tending to become saccate, varying in flowers of same plant, sub-equal	Slightly bifid, two-thirds the length of the anterior lobe	Bifid to subentire, sub-equal
Corolla—Wings	10 mm.	12 mm.	9-12 mm.	13-14 mm.	10 mm.
Corolla—Standard	9-10 mm.	10-12 mm.	7-9 mm.	11-13 mm.	9 mm.
Corolla—Keel	Markedly ciliate	Sparsely ciliate	Sparsely ciliate	Markedly ciliate	Markedly ciliate

(The co-operation and assistance of other botanists in procuring specimens of our Western lupines from all localities and habitats would be much appreciated.)

Empetrum nigrum, Linn.

Castletowers Ridge and Empetrum Peak.

Pachystima Myrsinites, Pursh.

Panorama Ridge, 5,000 feet.

Acer glabrum, Torr.

Common along Stony Creek and around Stony Lake.

Acer macrophyllum, Pursh.

Common on the lowlands along Pemberton Trail.

Acer circinatum, Pursh.

Common on the lowlands near Pemberton Trail.

Rhamnus Purshiana, DC.

Frequent along Pemberton Trail.

Viola palustris, Linn.

In Helmet Valley. (These specimens are the most typical I have obtained from any part of the Province.

Most of our former "marsh-violets" seem to belong to closely allied species.)

Epilobium paniculatum, Nutt..

Stony Creek.

Epilobium augustifolium, Linn.

Black Tusk Valley and Stony Creek.

Epilobium latifolium, Linn.

Near Helmet Glacier; Black Tusk slopes; Stony Creek; near Sphinx Glacier.

Epilobium luteum, Pursh.

Stony Creek. Common, but local.

Epilobium Hornemanii, Reichen.

Stony Creek, along with *E. paniculata*.

Epilbium alpinum, Linn.

Black Tusk slopes; near Sphinx Glacier.

Epilobium minutum, Lindl.

Stony Creek.

Fatsia horrida, Benth.& Hook.

Common along Pemberton Trail.

Osmorhiza nuda, Torr.

Mimulus Creek; Black Tusk slopes.

Enanthe sarmentosa, Presl.

Common by Pemberton Trail.

Heracleum lanatum, Michx.

Black Tusk slopes, Helmet Valley, etc.

Cornus Canadensis, Linn.

Common along Pemberton Trail and on lower slopes of Black Tusk.

Pyrola picta, Smith.

Pemberton Trail and above Stony Creek.

Pyrola secunda, Linn.

Pemberton Trail and on lower slopes of Black Tusk.

Pyrola rotundifolia bracteata. Gray.

Common all along Pemberton Trail and foot-hills of Black Tusk.

Moneses uniflora, Linn.

Frequent on foot-hills of Black Tusk.

Chimaphila umbellata (Linn.), Nutt.

Common along Pemberton Trail and on foot-hills of Black Tusk.

Allotropa virgata, Torr. & Gray.

Foot-hills of Black Tusk.

Monotropa uniflora, Linn.

Frequent along Pemberton Trail.

Cladothamnus pyrolæflorus, Bong.

Very common about 3,500 feet and associated with the white rhododendron and tall blueberry.

Rhododendron albiflorum, Hook.

Very common on foot-hills of Black Tusk from 3,500 to 5,500 feet. There is considerable variation in the colour of the corolla of this species, from practically pure white, to a yellowish or creamy white, the anterior and two lateral petals often having a few yellowish or orange coloured spots, which are usually pale in the whiter flowers or absent altogether. There is considerable variation also in the number of flowers, according to the nature of the soil and the exposure to sunlight. Plants in shade are usually less floriferous.

Menziesia glabella, Gray.

Common along Pemberton Trail, and on foot-hills of Black Tusk.

Loiseleuria procumbens, Desv.

Castletowers Ridge.

Kalmia glauca microphylla, Hook.

Helmet Valley; Castletowers Ridge.

Bryanthus. empetriiformis, Gray.

Common above 4,000 feet.

Bryanthus. empetriiformis intermedius, Gray.

Castletowers; Black Tusk slopes. (I agree with Dr. P. A. Rydberg in believing this to be a hybrid, as in all the areas where this was found it was associated with both *B. empetriiformis* and *B. glanduliflorus*.)

Bryanthus glanduliflorus, Gray. (Fig. 19, Report I.)

Common near perpetual snow and in the vicinity of glaciers on Panorama Ridge and Black Tusk.

Cassiope Mertensiana, Bong.

Common above 5,000 feet.

Gaultheria shallon, Pursh.

Common everywhere up to 2,000 feet.

Gaultheria Myrsinites, Hook.

Common on foot-hills of Black Tusk and on Panorama Ridge up to 5,500 feet.

Vaccinium macrophyllum (Hook), Piper.

Foot-hills of Black Tusk, constituting the underbrush from 3,300 up to 5,000 feet, and often associated with *Cladothamnus* and *Rhododendron*.

Vaccinium caespitosum, Michx.

Common on Black Tusk slopes and in Helmet Valley and Panorama Ridge.

Gentiana glauca, Pall.

Gentain Ridge near Castletowers.

Apocynum androsæmifolium, Linn.

Very common along Pemberton Trail near the beginning.

Phlox Douglasii, Hook. ([Fig. 14, Report I.](#))

Panorama Ridge; Black Tusk; Empetrum Ridge; near Sphinx Glacier. (The Garibaldi specimens are intermediate between the type and the var. *diffusa* (Gray). Specimens of this species collected on “The Lions” near Vancouver show the calyx almost glabrous, but one can usually find a few long White hairs present.)

Collomia heterophylla, Hook.

Frequent along Pemberton Trail. (Probably introduced to this district by “horse-feed,” as a few stray plants of oats are found here and there along the trail.)

Polemonium confertum, Gray.

Frequent on southern rocky slopes of Castletowers Ridge, overlooking Sphinx Glacier.

Phacelia sericea, Gray.

Black Tusk and Panorama Ridge.

Romanzoffia sitchensis, Bong.

On Corrie Ridge (north slopes).

Micromeria Douglasii, Benth.

Frequent along Pemberton Trail and on foot-hills of Black Tusk.

Pentstemon diffusus, Dougl.

Common along Pemberton Trail to Stony Creek, also found on Sentinel Ridge (5,000 feet).

Pentstemon Menziesii, Hook.

Black Tusk; Panorama Ridge; Pemberton Trail; near Sphinx Glacier.

Pentstemon confertus var. *cærulea-purpurens*, Gray.

Panorama Ridge, Helmet Valley, Black Tusk slopes, etc.

Mimulus Lewisii, Pursh.

Moraine near Sphinx, Mimulus Creek, Helmet Valley, etc.

Mimulus alsinoides, Dougl.

Rare, Pemberton Trail.

Veronica alpina, Linn.

Common on slopes of Black Tusk, etc., from 4,600 to 5,500 feet.

Castilleia miniata, Dougl.

Common, Black Tusk slopes; near Sphinx Glacier.

Castilleia angustifolia, Nutt.

Frequent on Black Tusk slopes, etc.

Castilleia pallescens, Greenman.

Common on Black Tusk Valley.

Pedicularis bracteosa, Benth.

Common on Black Tusk slopes above 5,000 feet.

Pedicularis racemosa, Dougl.

Near Stony Lake and near Camp, 4,000 to 5,200 feet. Locally common.

Boschniakia strobilacea, Gray.

On foot-hills of Black Tusk; a parasite on roots of salal.

Sambucus racemosa, Linn.

Common along Pemberton Trail.

Symphoricarpos racemosus, Michx.

Common along Pemberton Trail.

Linnæa borealis longiflora, Torr.

Common along Pemberton Trail and on foot-hills of Black Tusk.

Lonicera cærulea, Linn.

On slopes of Panorama Ridge near Mimulus Creek. One specimen was found in flower which seemed to differ from the others in having absolutely glabrous leaves of a thinner texture, more resembling *L. utahensis* (Wats.), but, as no fruits were found, it cannot be with certainty recorded as such.

Valeriana sitchensis, Bong.

Common from 4,000 to 5,800 feet.

Campanula rotundifolia, Linn.

Pemberton Trail; Castletowers. (The plants found at 7,000 feet were much dwarfed.)

Aplopappus Lyallii, Gray.

Common in higher mountains, Panorama Ridge, Black Tusk, etc., 6,000 to 7,000 feet near Sphinx Glacier.

Solidago multiradiata, Gray.

Panorama Ridge, Black Tusk, etc., about 6,000 feet; near Sphinx Glacier

Aster foliaceus, Lindl.

Stony Lake; Lesser Garibaldi Lake, Black Tusk slopes, 4,400 to 5,500 feet. (Those specimens collected at the lower altitudes are taller, no doubt due to a longer growing period, greater protection, a more abundant supply of water, and better soil. The specimens found at the higher altitudes are dwarf and exhibit considerable variation, showing a gradual transition between the extreme forms. It is probable that some of the "varieties" or so-called "closely allied species" may be represented by some of these variations.

Erigeron salsuginosus, Gray.

Common in Black Tusk slopes and Helmet Valley.

Erigeron acris, Linn.

Barrier, Stony Creek, and Sphinx Glacier.

Erigeron compositus, Pursh.

Panorama Ridge, Black Tusk, etc. Common, but local.

Erigeron compositus discoideus, Gray.

Panorama Ridge; Sphinx Glacier.

Antennaria rosea, Greene.

Sentinel Ridge; Corrie Ridge; near Sphinx Glacier.

Antennaria lanata, Greene.

Panorama Ridge; Corrie Ridge; Black Tusk.

Antennaria media, Greene.

Panorama Ridge; Black Tusk.

Anaphalis margaritacea, Benth. & Hook.

Common along Pemberton Trail to Stony Creek.

Achillea millefolium, Linn.

Castletowers Ridge, 7,000 feet.

Artemisia norvegica var. *longepedunculata*, Rudolphi (Comb. nov.).

Panorama Ridge and various places in the region of Helmet Glacier. There seems to be considerable difference of opinion regarding the nomenclature of this species in Western botanical works. In Gray's & Coulter's "Western Botany" our plant is described under *A. norvegica* (Fries). In Professor C.V. Piper's "Flora of the State of Washington" it is referred to *A. longepedunculata* (Rudolphi), and *A. norvegica pacifica* (Gray) is given as a synonym. In Coulter & Nelson's "Manual of Rocky Mountain Botany" it is called *A. saxicola* (Rydb.), and *A. norvegica* is given as a synonym, followed by a statement to the effect that. "True *A. norvegica* does not occur on this continent."

As there are vast areas of unexplored mountainous country in our northern regions, no one is justified in making such a sweeping assertion; and, if it has not been found, there seems no reason why it may not yet be collected.

In this connection it is interesting to note that several of the plants associated with our specimens belong to species common to Europe and North America, such as *Silene acaulis*, *Empetrum nigrum*, and *Loiseleuria procumbens*.

If our specimens are not mere variations of true *A. norvegica*, and if they are to be regarded as belonging to a distinct species, I agree with Professor Piper in adopting time oldest name, *A. longepedunculata* (Rudolphi); but I see no reason why it should be separated from *A. norvegica*. In this view I am supported by the "Index Kewensis," which turns down *A. longepedunculata* to *A. norvegica*.

There is no doubt that this species has a wide range of variation, both in regard to pubescence and the length of the peduncles. In our specimens some of the capitula are almost sessile, while others are borne on pedicels of varying lengths up to 70 mm., and this amount of variation may be found even on one plant.

In the description of *A. norvegica* the pubescence is given from villous to glabrate; most of our specimens are sparsely pilose, and there seems no doubt but that specimens collected near Mount Robson, B.C., and described by Mr. Paul C. Standley as a new species under the name *Artemisia lævigata*, are merely glabrate forms of the above, not being sufficiently glabrous to be referred to *A. Parryi* (Gray), which is absolutely glabrous in all its parts, including the corolla.

One of our specimens is perfectly glabrous in all its parts except the few hairs on the corolla; if they too had disappeared it would, according to some botanists, have then been referred to another species (:*A. Parryi*, Gray).

The occasional pubescence on the corolla of the so-called "*A. lævigata*" serves to connect *A. Parryi* with our species, and I think Professor Nelson, in his revision of Coulter's "Flora" is right in regarding *A. Parryi* merely as a variety instead of as a separate species.

In a communication received from James M. Macoun, Esq. (Curator of the Dominion Government Herbarium at Ottawa), regarding *Artemisia longepedunculata*, he says: "I must confess that, while the name may be good for extreme forms, we have intermediate specimens that make me doubt whether the whole thing is not *A. norvegica*," and he informs me that he collected his series "from between Vancouver Island and Behring Straits, where we find true *norvegica*."

Believing that true *A. norvegica* does occur on this continent, and knowing the wide range of variation in our specimens. I can only regard them at the most as a variety of *A. norvegica*, not being sufficiently distinct to entitle them to specific rank.

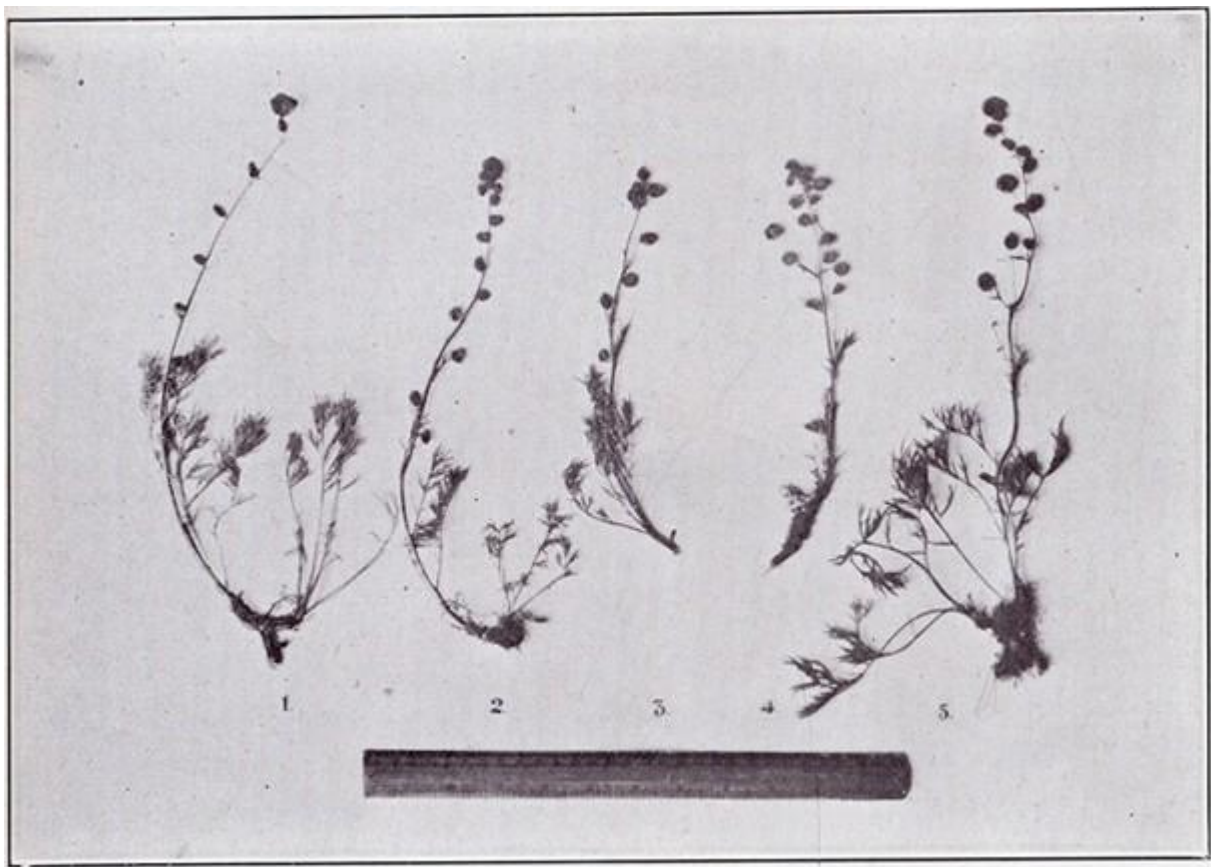


Fig. 60. Variation in *Artemisia*. (1) Heads almost sessile; (2, 3, and 4) variation in length of pedicels; (5) glabrous form.
 [Herbarium sheets; [One](#) — [Two](#)]

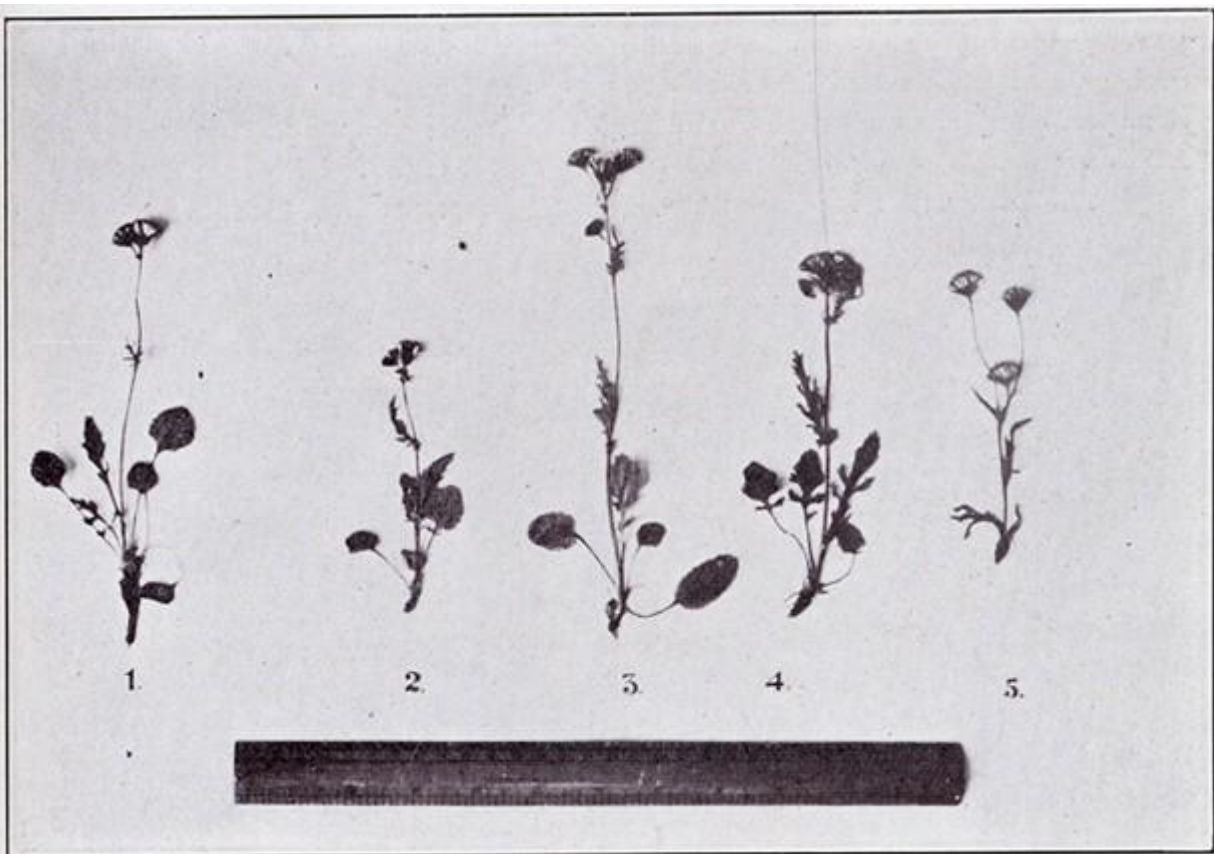


Fig. 61. Variation of *Senecio*. Note bases of leaves, number of capitula, length of pedicels, and size of cauline leaves.
 [Larger [Image](#)]

As the name *longepedunculata* was applied to our plant before Dr. Gray gave the name *A. norvegica* var. *pacifica*, it seems to me that the new combination *A. norvegica longepedunculata* (Rudolphi) is in accordance with the Vienna Rules, and the following are evidently synonyms:—

Artemista longepedunculata, Rudolphi. 1834.

A. norvegica pacifica, Gray. 1884.

A. saxicola, Rydberg. 1905.

A. lævigata, Standley. 1912.

Petasites nivalis, Greene.

Stony Lake and Black Tusk.

Arnica Parryi, Gray.

Near south end of Garibaldi Lake; near Sphinx Glacier.

Arnica lævigata, Greene.

Black Tusk slopes, etc.

Arnica alpina, Linn.

Black Tusk slopes, etc.

Arnica cordifolia, Hook.

Black Tusk Slopes and Helmet Valley.

Senecio triangularis, Hook.

Stony Lake, Black Tusk, etc.

Senecio Fremontii, Torr. & Gray.

East slopes of Black Tusk; moraine of Sphinx Glacier; north-east of Helmet Glacier.

(Our specimens have the typical glabrous and angular fruits.)

Senecio aureus var. *discoideus*, Hook. ([Fig. 60.](#))

Panorama Ridge; near Helmet Glacier; also near Sphinx Glacier. *Senecio aureus* of Linneaus seems to be about as polymorphic a species as any species could well be; indeed, this is admitted by most botanists who have done any work on it. Dr. Gray endeavoured to separate the different forms into varieties based more or less on the height of the plant, the shape of the radical leaves, and occasionally by the particular Shade of yellow exhibited in the flowers. Since then other botanists including Dr. P.A. Rydberg, Professor E.L. Greene, Professor J.M. Greenman, and others, have set to work to mark off certain limits of variation, and apply specific names to those forms which come within those limits.

Each seems to have done his best to segregate those species according to the characters which he considered of most importance, and when each individual's work has been studied by itself, one feels that not a little has been done towards the segregation of the numerous forms into at least well-marked varieties, if not into species. (Professor Greene, in "Pittonia, IV., page 115", considers *S. aureus* as "an aggregate of some dozen or two of species.") But when one compares ones specimens with the different descriptions of the so-called "species" or varieties as supplied by the various authors, one sees the futility of the attempts to delimit the various forms by laying importance on characters which are so liable to vary according to the environment of the particular specimen.

The specimens found at Garibaldi, and which I have referred to *S. aureus discoideus* (Hook.), seem to vary so much in minor details that some of them might easily be referred to other varieties or so-called "species"; that is to say, they do not show all the particular degrees of variation to place them exactly within the limits of one of those species or varieties which have been so artificially defined.

According to Piper's "Flora of Washington," our plant is *S. pauciflorus* (Pursh). The "Index Kewensis" refers *S. pauciflorus* to *S. aureus*; and Britton and Brown's "Flora of North America" (latest edition) gives *S. pauciflorus* as a synonym of *S. aureus*; yet Professor Piper distinguishes *S. pauciflorus* by its discoid heads, whereas *S. aureus* is given as having conspicuous rays. According to Britton and Brown's "Flora of North America" and Coulter and Nelson's "Manual of the Rocky Mountains," our plant is *S. discoideus* (Hook.), Britt. & Br., and *S. aureus discoideus* (Hook.) is given as a synonym; while in Gray and Coulter's "Manual of the Rocky Mountains" our specimens connect *S. aureus borealis* with *S. aureus croceus*. (The latter is raised to specific rank by Professor Rydberg under the name *S. croceus*.) The majority of our specimens had absolutely no trace of ray florets; but, on minute examination, two or three specimens were found with small inconspicuous rays, shorter than, or scarcely exceeding, the bracts of the involucre.

Regarding the colour, I am of the opinion that this depends largely on environment, because the majority of specimens found in proximity to glaciers had a rich brownish-orange or copper colour, while the majority of those growing in more sheltered places were much lighter, ranging to pale yellow. The colour, however, was not invariable, there being exceptions in both habitats.

Regarding the comparative size of radical and cauline leaves, our specimens vary greatly. Some are well supplied with radical leaves corresponding in size and shape to *S. aureus discoideus*, but most of them have crenate-serrate margins instead of sharply serrate.

This seems to connect those crenate-dentate forms with the sharply serrate ones. Other specimens showed only remnants of radical leaves, small and withered, while the cauline leaves were greatly developed, giving the plant an entirely different appearance. This is a frequent form, and I think can be explained by the probability that an early disappearance of snow allowed the radical leaves to develop, and, while still young, as the result of freezing winds, they were destroyed. It is natural, therefore, that the remaining food—store should be utilized by the only other available leaves—the cauline ones—resulting in a different-looking plant.

The peduncles, too, in our specimens vary from almost sessile to over 7 cm. in length.

Several live plants were brought out to be grown in the Botanical Nursery for future study on variation, and also to observe the relation of the change of environment on the presence or absence of ray florets.

Senecio lugens, Richards.

Black Tusk slopes.

Carduus edulis, Greene.

Black Tusk slopes and Helmet Valley.

Taraxacum scopulorum (Gray), Ryd.

Gentian Ridge.

Troximon glaucum dasycephalum, Torr. & Gray.

Black Tusk.

Troximon glaucum parviflorum, Gray.

Moraine of Sphinx Glacier.

Troximon aurantiacum, Hook.

Empetrum Ridge and Black Tusk slopes.

Crepis nana, Richards.

Between Black Tusk and Empetrum Ridge.

Hieracium gracile, Hook.

Black Tusk slopes, near Garibaldi Lake, etc.

(10.) Botanical Research.

During the identification of plants for the Herbarium and for correspondents, it has been necessary to note from time to time certain species or groups of species which require to be studied more fully in the field. This is often due to the lack of information on important points in the descriptions of many of our native species, or to undue prominence being laid on characters of little value on account of their variability.

It is hoped that by bringing all our field observations and all our available literature and information to a focus a little more light will be got regarding each of the selected species. The notes incorporated in the list of Garibaldi plants and in other parts of the report may be of service in prompting other botanists to co-operate by supplying the results of their field observations, So that we may come to a fuller knowledge of the variation of species under different conditions.

If botanists would take a wider view of the distribution and variation of species, our "Floras" would soon get rid of much of the confusion which at present exists regarding certain genera. It is when one specializes in some particular genus that this chaos is most felt, and specialists have repeatedly stated that the further they pursue their investigations, the deeper they find the confusion.

The research on the genus *Newberrya*, summarized in [last year's report](#), has supplied information and data which by having ascertained the true structure of the pistil will necessitate the modification of its generic characters. The cleaning-up of this point, which has remained obscure since 1855, enabled us to record our plant definitely as *Newberrya congesta* (Torr.). This constitutes another new record for British Columbia, and, as far as can be ascertained, a new record for Canada.

Following the study of the range of variation in this species, I ventured to suggest that various other species of this genus were merely forms of the same plant in different stages or from different habitats; and after the publication of the data a communication was received from Professor W.L. Jepson, of the University of California, supporting this suggestion. It is therefore likely that in the near future we will see most, if not all, of our Western species of *Newberrya* included as synonyms of *Newberrya congesta*, thus clearing up some of the confusion which has resulted through describing new species from insufficient or immature specimens.

It is hoped that some of the work done on other species this year may ultimately lead to a similar result.

(11.) Publications.

On account of the lateness in issuing our first report—being well into the month of August—and owing to time extra pressure of office-work during the collecting season, no other publications have been issued this year.

As there is an increasing demand from teachers and other correspondents for information on the collection and preservation of plants for the Herbarium, it is expected that before next summer a beginning will be made with the series of leaflets, so that collectors may make the most of their opportunities during the season.

The series on this subject will supply modern methods on the selection and preservation of material, so that all the preparations in our school herbaria or private herbaria may be of standard size and in conformity with those in the Provincial Herbarium.

It is expected that sufficient material will be available after this year's Dry Belt collection has been worked out to make a commencement with the bulletin series, as referred to in section 8 of the report.

It is proposed to supply details regarding the flora and to give the results of field observations on one or two particular species; at the same time, the information gathered concerning the plants used by the Indians of that region may prove useful, as well as interesting.

(12.) Acknowledgments.

Before concluding the second report of the Botanical Office, I beg to acknowledge the co-operation and valued assistance of several well-known botanists who have shown their interest in our work by examining some of our critical species or by supplying specimens for comparison with ours.

The following are amongst those to whom our thanks are due: Professor W.L. Jepson, University of California, for enabling us to obtain specimens of *Amelanchier glabra* for future research; Professor E.L. Greene, for the examination of some critical species, helping us in their determination; Professor A.S. Hitchcock, Professor C.V. Piper, and Dr. M.O. Malte, for assistance in verifying our identification of grasses; Professor C.S. Sargent, for identifying cones of *Abies*; Sir David Prain, Kew, for seeds of special grasses for the Botanical Garden; William R. Maxon, Esq., United States National Herbarium, for loan of herbarium specimens of *Amelanchier* for comparison.

Respectfully submitted.

John Davidson,

Provincial Botanist,

Victoria, B.C.

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No attempt was made to correct the systematic names, and the text itself.

Larger Images, are externally linked to the [Botany John website](#)

The first annual report is available at [Internet Archive](#)

John Davidson, "[Botany John](#)" blog